NEW AND RECONSIDERED MEXICAN UMBELLIFERAE

by

MILDRED E. MATHIAS
and
LINCOLN CONSTANCE

University of California, Los Angeles and Berkeley

CONTRIBUTIONS FROM THE UNIVERSITY OF MICHIGAN HERBARIUM
Volume 11, No. 1, pp. 1–24, 11 figures in text

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In the three decades since we attempted to summarize the Family Umbelliferae as represented in North America (Mathias & Constance, 1944–45), a great deal of material and information has accumulated, much of which pertains to Mexico. We have tried to be conservative in offering new proposals; nevertheless, one new genus and nearly a dozen new species have been described, most of them by one or both of us. Since we have not ourselves undertaken serious field work in Mexico, we are particularly grateful for the generous efforts of staff members and students from other institutions as well as our own who have provided us with a steady flow of specimens, seed, and buds. We should like to mention particularly John H. Beaman, C. Ritchie Bell, Dennis E. Breedlove, Robert W. Cruden, James A. Duke, Theodore F. Niehaus, George Pilz, Peter H. Raven, Harbert Rice, John L. Strother, Stephen G. Weller, and the late Elwood Molseed. A number of problems have been clarified by large collections made by Dr. Jerzy Rzedowski and his pupils at the Instituto Politécnico Nacional in Mexico City and by Dr. Rogers McVaugh and the large group of Ann Arbor students who have participated actively in Mexican botanical exploration at some time in their careers. We are glad to have the opportunity to record here some of our new information, as it relates to the genera *Donnellsmithia, Tauschia, Arracacia, Coaxana, Prionosciadium, Rhodosciadium,* and *Eryngium.*

We are grateful to the curators of the following herbaria for the opportunity to examine material: B, CAS/DS, G, ENCB, K, MICH, NCU, NY, P, UC, US, W. We wish also to express appreciation for the support of the National Science Foundation, GB 1293 and 13,393, and GB 525 and 6741, respectively.

Donnellsmithia pinnatisecta (Riley) Math. & Const., comb. nov.

Museniopsis biennis var. *pinnatisecta* Riley, Kew Bull. 1924: 222. 1924.

Stout to slender biennial or perennial from a slender or swollen taproot, 5.5–10 dm high, the foliage and often also nodes scaberulous; leaves orbicular to ovate-deltoid, 7–15 cm in diameter, 1–2-ternate, ternate-pinnate or bipinnate, the leaflets broad, ovate, 3.5–8 cm long, 1–5 cm broad, acute or acuminate at apex, cuneate to truncate at base, coarsely serrate to lobed toward base, scaberulous on veins, margins, and rachises, or glabrate; petioles 5–20 cm long, sheathing at base, the sheaths scarious-winged; cauline leaves reduced upwards with narrow, elongate, saliently lobed divisions, the uppermost opposite or alternate, ternate or entire, the scarious sheaths conspicuous; inflorescence dichotomously branched, the umbels pedunculate to sessile; involucre wanting; rays 2–9, filiform, unequal, 10–40 mm long; involucel of a single bractlet or wanting; fertile pedicels 1–4, filiform, 2–8 mm long, longer than sterile pedicels; flowers yellow; stylopodium low, scarcely evident; fruit broadly ovoid, 2 mm long, 2.5 mm broad, cordate at base, rounded but narrowed toward apex, glabrous, the ribs filiform, obscure; vittae several in intervals and on commissure; seed face sulcate.

TYPE: Sierra Madre, N. W. Mexico, *Seemann 2134* (K, type; UC, photo).

DISTRIBUTION: Pine, fir, or oak woods at 1050–2800 m altitude, Sinaloa to Guerrero.

Other collections examined:

SINALOA: Ocurahui, Sierra Surotato, 1–10 Sep 1941, *H. S. Gentry 6281* (UC).

NAYARIT: Mountains 10 mi N of Compostela, 27 Aug 1957, *McVaugh 16,470* (MICH, UC); road to lake, Santa María del Oro, 13 Oct 1963, *Schubert & Sousa 2077* (UC).

JALISCO: Sierra de Cuale, SW of Talpa de Allende, 19–21 Nov 1952, *McVaugh 14,310* (MICH, UC).

GUERRERO: Carrizal, 9 km W of Camotla, Mpio. Chichihualco, 1 Dec 1963, *J. Rzedowski 18,047* (ENCB, MICH); 1 mi W of Omiltemi, 14 Jun 1953, *D. R. Richards 3282* (MICH); Omiltemi, 20 km W of Chilpancingo, 1 Sep 1962, *Rzedowski 15,954* (ENCB, UC); Toro Muerto, Mina, 29 May 1939, *Hinton et al. 14,324* (UC); E & N slopes of Cerro Alquitrán, 12–16 km by road W of route 95, W of Mazatlán, 29 Jul 1968, *W. R. & C. Anderson 4967* (MICH).

This taxon was based on a collection reported as *Velaea tolucensis?* in the Botany of the Herald Expedition (Seemann, 1852–57, p. 294) and as *Arracacia* sp. by Hemsley (1879–80, p. 564), although the latter subsequently indicated to Coulter and Rose that it belonged with *Pringle 4620.* This Pringle collection, from the hills of Pátzcuaro, Michoacán, was referred by Coulter and Rose in 1895 to *Museniopsis aegopodioides,* but in 1900 it became the type of their *M. biennis,* that is, *Donnellsmithia biennis* (Coult. & Rose) Math. & Const. Constance noted at Kew in 1963, "Probably an undescribed species of *Donnellsmithia,* nearest to *D. hintonii* and *D. biennis,* especially the latter."

Despite the recent collections, we cannot yet be entirely certain that all the material cited actually belongs to a single taxon or that, if it does, it is necessarily conspecific with the Seemann collection. The Guerrero material has an apparently perennial root, more scaberulous foliage, and a less diffusely branched inflorescence than more northerly material. The leaves of the Seemann collection are more dissected than those of any other specimens we have seen. In both cases, however, the similarities appear to outweigh the differences and to lend support to the taxonomic disposition proposed here. With its long fertile pedicels, several vittae, indistinct stylopodium and fruit ribs, *D. pinnatisecta* suggests *D. mexicana* and *D. hintonii,* but its much greater stature and very broad radicle leaves and leaflets give it quite a different appearance.

Donnellsmithia ampulliformis Math. & Const., sp. nov. FIG. 1

Plantae perennes caulescentes alternatim ramosae 3–5 dm altae e radice magna crassa, foliis inflorescentiisque hirsutulis minute scaberulisque; folia oblongo-ovalia 3–7(–10) cm longa 2.5–5(–10) cm lata pinnata, foliolis 3–7 late ovatis orbiculatisve subsessilibus obtusis dentatis hirsutulis; petioli 3–10 cm longi anguste vaginantes; folia caulina alterna; pedunculi 2–8 cm longi alterni; involucrum nullum; involucelli bracteolae 4–6 lineares 1–2 mm longae; radii 4–7 subaequales 1–2 cm longi; pedicelli fertiles 1–3 ca 2 mm longi; flores atropurpurei; stylopodium manifestum breve, stylis ca 2 mm longis; carpophorum usque ad basim bifidum; fructus ovoideo-orbiculatus diametro 3 mm ad apicem versus attenuatus minute scaberulus, costis filiformibus; vittae commissurarum et eae in intervallis paucae; seminis superficies concava.

Slender perennials from a massive taproot, 3–5 dm high, the stem alternately branched, moderately leafy, the stems and foliage hirsutulous, the rays scaberulous; leaves oblong-oval, 3–7(–10) cm long, 2.5–5(–10) cm broad, simply pinnate with 3–7 broadly ovate to orbicular, subsessile, obtuse, dentate leaflets (or the terminal or basal occasionally 3-lobed or 3-foliolate), hirsutulous beneath at least on veins, rachis, and upper petiole; petiole 3–10 cm long, narrowly scarious-sheathing; cauline leaves alternate, reduced upward; peduncles alternate, 2–8 cm long (rarely some obsolete and umbels sessile); involucre wanting, or rarely of a leaflike bract; rays 4–7, subequal, 1–2 cm long; involucel of 4–6 linear bractlets 1–2 mm long; fertile pedicels 1–3, ca 2 mm long; flowers dark purplish-red; stylopodium low conic, evident; styles ca 1 mm long; carpophore 2-cleft to base; fruit ovoid-orbicular, 3 mm long, 3 mm broad at base, narrowed to 1.5 mm and truncate at apex, minutely scaberulous, the ribs low, filiform, a V-shaped depression separating mericarps at apex; vittae small, several in intervals and on commissure; seed face concave.

TYPE: GUERRERO: Steep-walled limestone sinks, oak woods, limestone mountains between Chilpancingo and Omiltemi, 11.5–15 mi W of former, elev. 1960–2020 m, 27–28 Jul 1968, *W. R. Anderson & C. Anderson 4922* (MICH, type; UC).

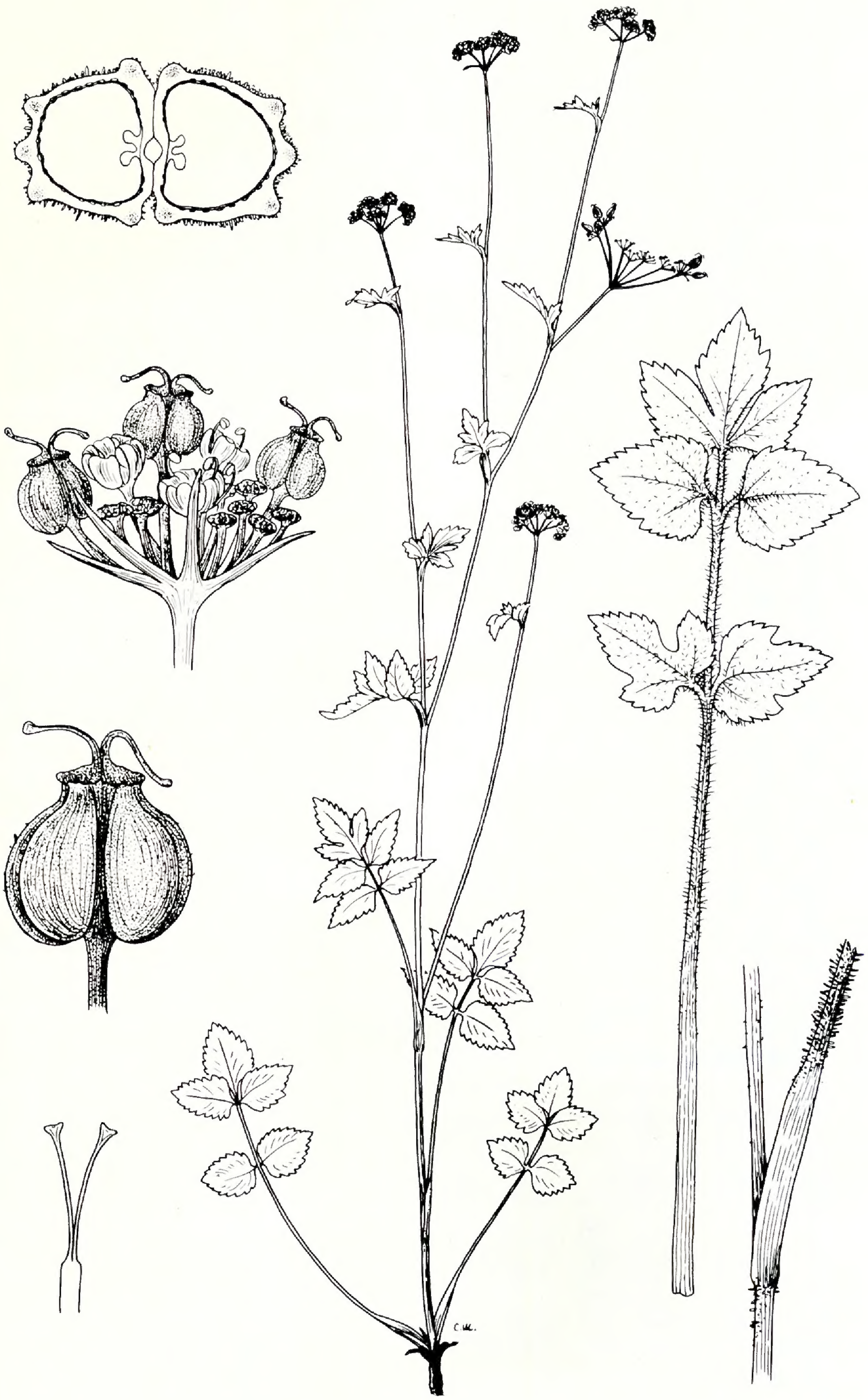

FIG. 1. *Donnellsmithia ampulliformis.* Habit, × 1/2; basal leaf, × 1½; cauline leaf base, × 1½; umbellet, × 6; mature fruit, × 8; carpophore, × 6; fruit transection, × 13 (all from the type collection).

Other collections examined:

MICHOACAN: Pine forest, Sierra Naranjillo, Coalcomán, 13 Jul 1939, *G. B. Hinton et al. 13,992* (UC).

With its slender caulescent habit, simply pinnate leaves, purplish-red flowers, and stubby flask-shaped fruit, this species is unlikely to be confused with any other Mexican umbel thus far known. The immature Hinton collection of 1939 has much larger leaflets, but appears to be otherwise the same; we have seen no fruiting material from Michoacán.

Donnellsmithia juncea (Humb. & Bonpl. ex Spreng.) Math. & Const., comb. nov.

Peucedanum junceum Humb. & Bonpl. ex Spreng. in R. & S. Syst. Veg. 6: 572. 1820. Based upon *Humboldt & Bonpland 2039:* "In America Meridional." (B, type; UC, photo).

Cnidium peucedanoides Kunth in HBK. Nov. Gen. & Sp. 5: 15. 1821; *Silaus ? peucedanoides* DC. in DC. Prodr. 4: 161. 1830; *Eulophus peucedanoides* Benth. & Hook. ex Hemsl. Biol. Centr. Amer. Bot. 1: 565. 1880; *Museniopsis peucedanoides* Coult. & Rose, Contr. U.S. Nat. Herb. 3: 303. 1895; *Valaea peucedanoides* Drude in E. & P. Nat. Pfl. 3[8]: 169. 1898; *Tauschia peucedanoides* F. Macbr. Contr. Gray Herb. II. 56: 32. 1918; *Donnellsmithia peucedanoides* Math. & Const. Bull. Torrey Bot. Club 68: 122. 1941. Based upon *Humboldt & Bonpland 2039:* "Flumen Putes, Popayan" [Colombia] (P, type).

Smyrnium ? lineare Benth. Pl. Hartw. 83. 1841. Based upon *Hartweg 578:* "In arvis Tejar et Chimaltenango" [Guatemala] (K, type).

At the time of preparing our revision of Umbelliferae for NORTH AMERICAN FLORA (1944-45) we were aware that *Peucedanum junceum* was an older name than *Cnidium peucedanoides,* but we had no way of confirming that both were applicable to the same taxon. A photograph of the specimen in the Willdenow Herbarium, obtained through the courtesy of Dr. Theo Eckardt, confirms the fact that the two are conspecific and based upon the same collection. Our earlier statement that "the species is not known from South America" is incorrect.

Since we have restricted somewhat the scope of this taxon by the removal of *Eulophus ternatus* S. Wats. and *Museniopsis schaffneri* Coult. & Rose, it seems appropriate to present a revised English description, viz. that of *Donnellsmithia juncea* var. *juncea*:

Slender perennial from a simple or branched taproot, the stem conspicuously fibrous at base, 3–12 dm high, the foliage minutely scaberulous; leaves deltoid to orbicular, 4–20 cm in diameter, ternately or ternate-pinnately dissected, the primary divisions petiolulate, the ultimate divisions linear to filiform, 0.5–10 cm long, 0.5–2 mm broad, acute and callous-tipped at apex, tapering at base, entire, glabrous or minutely scaberulous especially on rachis and petiolules; petioles 3–20 cm long, narrowly sheathing; cauline leaves reduced upward, mostly alternate, the uppermost ternate with filiform divisions; inflorescence cymosely branched, the peduncles opposite or alternate, 1.5–8 cm long, or infrequently one umbel sessile; involucre wanting; rays 4–6(–8), 1–3.5 cm long; involucel wanting, or occasionally of a single bractlet; fertile pedicels 1–6, 1–4 mm long, scarcely exceeding sterile pedicels; flowers yellow; stylopodium depressed, not evident; fruit ovoid, 3 mm long, 2.5–3 mm broad, narrowed at apex, cordate at base, glabrous, the ribs filiform, evident to indistinct; vittae several in intervals and on commissure; seed face sulcate.

DISTRIBUTION: In open pine and oak woods from Veracruz to Durango and Sinaloa, south to Guatemala and Honduras, and in both western Venezuela and northern Colombia, at elevations of 900–2500 m, flowering in June and July, fruiting from August to October.

Donnellsmithia juncea var. **purpurea** (Coult. & Rose) Math. & Const., comb. nov.

Museniopsis purpurea Coult. & Rose, Proc. Wash. Acad. 1: 132. 1900; *Donnellsmithia peucedanoides* var. *purpurea* Math. & Const. Bull. Torrey Bot. Club 68: 123. 1941. Based upon *Rose 2974*: "In the Sierra Madre, west of Bolaños," Jalisco.

We have no further information on this purple-flowered variant except that it has now been obtained as far south as Oaxaca (*R. W. Cruden 1424,* UC).

Donnellsmithia ternata (S. Wats.) Math. & Const., comb. nov.

Eulophus ternatus S. Wats. Proc. Amer. Acad. 23: 276. 1888; *Museniopsis ternata* Coult. & Rose, Contr. U.S. Nat. Herb. 3: 303. 1895; *Velaea ternata* Drude in E. & P. Nat. Pfl. 3[8]: 169. 1898. Based upon *Pringle 1252:* "Pine plains at the base of the Sierra Madre, Chihuahua," Sep 1887.

Museniopsis schaffneri Coult. & Rose, Contr. U.S. Nat. Herb. 3: 303. 1895; *Velaea schaffneri* Drude in E. & P. Nat. Pfl. 3[8]: 169. 1898. Based upon *Schaffner 5, & 550*: "rupestris prope San Miguelito," 1876, 1879; *Parry & Palmer 293,* in 1878, all from San Luis Potosí.

Museniopsis ternata var. *filifolia* Coult. & Rose, Contr. U.S. Nat. Herb. 3: 303. 1895. Based upon *Pringle 1519*: "in canyons, Sierra Madre, Chihuahua," 1 Oct 1887.

Slender perennial from a slender taproot, the stem without fibers at base, 2–7 dm high, glaucous and essentially glabrous throughout; leaves deltoid, 5–13 cm long, 6.5–14 cm broad, biternate or ternate-1–2-pinnate, the leaflets linear-lanceolate to filiform, 1–8(–12) cm long, 0.5–6 mm broad, acute and callous-tipped at apex, tapering at base, entire, glabrous or minutely scaberulous; petiole 3.5–17 cm long; cauline leaves alternate, the uppermost ternate with filiform divisions or entire; peduncles alternate, 2–10 cm long, usually one umbel sessile; involucre wanting, or of a single linear bract; rays 4–8, 1.5–5.5(–7.5) cm long, unequal; involucel usually wanting; fertile pedicels 1–3, 2–8(–10) mm long, longer than sterile pedicels; flowers yellow; stylopodium depressed, not evident; fruit ovoid, 2–4 mm long, 2.5–3 mm broad, slightly narrowed at apex, cordate at base, glabrous, the ribs filiform, indistinct; vittae several in intervals and on commissure; seed face sulcate.

DISTRIBUTION: In and near wooded slopes and summits, Coahuila to Chihuahua, S to Tamaulipas, Durango, and Aguascalientes, elev. 2200–3400 m, Jul-Sep.

Donnellsmithia ternata differs from *D. juncea,* with which we had previously attempted to combine it, by its lack of a conspicuous fibrous stem base, the fact that it usually has at least some umbels sessile, the tendency of the rays to be unequal, and the fact that the fertile pedicels conspicuously exceed the sterile ones. Both species are late summer-blooming and widespread inhabitants of oak-pine woodlands, *D. ternata* being somewhat northerly in its distribution and usually occurring at higher altitudes.

Donnellsmithia guatemalensis Coult. & Rose, Bot. Gaz. 15: 15. 1890.

Museniopsis scabrella Coult. & Rose, Contr. U.S. Nat. Herb. 3: 304. 1895; *Velaea scabrella* Drude in E. & P. Nat. Pfl. 3[8]: 169. 1898; *Tauschia scabrella* F. Macbr. Contr. Gray Herb. II. 56: 33. 1918. Based upon *Pringle 5550*: "on the Sierra de San Felipe," 7000 feet, 10 Sep 1894, and *Nelson 1900*: "in oak woods on the mountain ridges on west side of Valley of Cuicatlan," 7500–8000 feet, 10 Nov 1894, both Oaxaca (US, syntypes).

Study of a recent very ample collection of *Donnellsmithia guatemalensis*, the type species of the genus, from Dept. Quezaltenango, Guatemala (*R. W. Cruden 1566*), and re-examination of the Pringle collection reveal that *Museniopsis scabrella* is synonymous with *D. guatemalensis* rather than with *D. cordata* (Coult. & Rose) Math. & Const., where we had assigned it earlier (1944–45).

Tauschia ehrenbergii (H. Wolff) Mathias, Ann. Missouri Bot. Gard. 17: 269. 1930.

Musineum ehrenbergii H. Wolff, Repert. Sp. Nov. 8: 524. 1910.

Acaulescent, erect or ascending from several elongate tuberous roots, 2–10 cm high or long, the foliage glaucous and glabrous, the inflorescence glabrous to puberulent; leaves oblong, 2–3 cm long, 1–1.5 cm broad, pinnate, the leaflets lanceolate to ovate-lanceolate, distinct or the terminal confluent, sessile, 2–6 mm long, 1–4 mm broad, subentire, the margins reflexed; petioles 1–4 cm long, wholly sheathing; peduncles 2–4 cm long; involucre wanting; rays 3–9, unequal, 3–10 mm long, winged-sulcate, squamulose-scabrid at base; involucel of 5–7 linear, acuminate, entire bractlets 3–5 mm long, exceeding flowers but shorter than fruit; pedicels thick, 1.5–2.5 mm long; flowers white; styles broad and tape-like, slender, recurved; fruit narrowly ovoid-elliptic, 4–5 mm long, 2–2.5 mm broad, the ribs thick, prominent; vittae solitary in intervals, 2 on commissure; seed face deeply sulcate.

TYPE: "Cerro Pelado," "Cerro de las Navachos," Oaxaca, *Ehrenberg 851.*

Other collections examined:

VERACRUZ: "Pr. Mirador prov. Veracruz, 3000–3800 m," Apr 1856, *C. Sartorius 138* (W).

OAXACA: From Monte Pelado and on Canetze [Tanetze] ENE from Oaxaca, Aug 1845, *C. Jurgensen 357* (G).

Examination of the two additional collections listed permits an expansion of the very skimpy descriptions provided earlier and an identification of the type locality. So far as we are aware, the species has not been collected in the past century.

Tauschia decumbens (Benth.) Coult. & Rose ex Drude in E. & P. Nat. Pfl. 3[8]: 170. 1898.

Velaea decumbens Benth. Pl. Hartw. 38. 1840; *Arracacia decumbens* Benth. & Hook. ex Hemsl. Biol. Centr. Amer. Bot. 1: 564. 1880. Based upon *Hartweg 297*: "In arvis, Morelia" and *Graham 263*: "in planitie Topotongo et ad Tlalpuxahua" (K, syntypes).

Arracacia mariana S. Wats. Proc. Amer. Acad. 26: 136. 1891; *Tauschia mariana* Coult. & Rose ex Drude in E. & P. Nat. Pfl. 3[8]: 170. 1898. Based upon *Pringle 3480*: "On hillsides at Flor de Maria," México.

Tauschia roseana H. Wolff, Repert. Sp. Nov. 9: 418. 1911. Based upon *Schiede 603*: "Cumbre de las papas," Aug.

Velaea decumbens Benth., which we earlier placed in synonymy under *Tauschia nudicaulis* Schlecht., lacks the conspicuously cartilaginous-margined leaflets and somewhat united, lobed, and expanded involucel bractlets of the latter species. Instead it is to be associated with *Arracacia mariana* S. Wats., which it antedates by half a century.

Arracacia filipes Math. & Const., sp. nov. FIG. 2

Plantae graciles caulescentes ramosae 0.5–1.5 m altae, foliis inflorescentibusque glaucescentibus glabris vel minute scaberulis; folia triangulo-ovata biternata vel bipinnata diametro 1–6 dm, foliolis ovatis apice acuminatis basi truncatis cuneatisve duplicato-serratis 2.5–8 cm longis 1.5–5 cm latis; petioli anguste scarioso-vaginantes 8–20 cm longi; folia caulina superiora reducta plerumque ternata; inflorescentia pauciramosa terminalis lateralisve, pedunculis gracilibus 2–10 cm longis; involucrum nullum; radii 4–12 (2–5 fertiles) filiformes patenti-adscendentes 2–5 cm longi; involucelli bracteolae 3–5 lineares 2–3 mm longae; pedicelli filiformes patenti-adscendentes 10–20 mm longi; flores virides, petalis ovalibus; stylopodium depressum indistinctum, stylis gracilibus patenti-adscendentibus vel recurvatis usque ad 1 mm longis; carpophorum usque ad basim bipartitum divisionibus erectis; fructus oblongo-ovalis apice leviter attenuatus glaber 4.5–6 mm longus 2–2.5 mm latus, costis filiformibus; vittae magnae in intervalis tantum una et in commissuris plerumque 2; semen sub vittis canaliculatum superficie profunde sulcata; chromosomatum numerus $n = 22$.

FIG. 2. *Arracacia filipes.* Habit, × 1/2; basal leaf, × 1/2; petal, × 20; fruit, × 5; fruit transection, × 15 (all from the type, *Gordon 51*).

Slender, caulescent, branching, the stem purplish, glaucous, erect, 0.5–1.5 m tall from a taproot, the foliage and inflorescence glabrous to minutely scaberulous; leaves triangular-ovate, 1–6 dm long and broad, biternate or bipinnate, the leaflets ovate, acuminate at apex, truncate to cuneate at base, doubly serrate, 2.5–8 cm long, 1–5.5 cm broad; petioles 8–20 cm long, narrowly scarious-sheathing at base; cauline leaves reduced upward, often ternate; inflorescence few branched, terminal and lateral, the peduncles slender, 2–10 cm long; involucre lacking; rays 4–12 (2–5 fertile), filiform, 2–5 cm long, spreading-ascending; involucel of 3–5 linear bractlets 2–3 mm long; pedicels filiform, spreading-ascending, 10–20 mm long; flowers green, the petals oval; stylopodium indistinct and depressed, the styles slender, spreading-ascending to recurved, to 1 mm long; carpophore parted to base, the halves erect; fruit oblong-oval, 4.5–6 mm long, 2–2.5 mm broad, glabrous, tapering slightly at apex, the ribs filiform; vittae large, solitary in intervals, usually 2 on commissure; seed channeled under intervals, the face deeply sulcate; chromosome number $n = 22$.

TYPE: DURANGO: "Arroyo del Infierno"; deep, well-watered, rough rocky canyon W of Santa Barbara, ca 20 km S of El Salto, elev. 2550–2650 m, 23, 24 Aug 1963, *Alan G. Gordon 51* (MICH, type; UC, photo).

Other collections examined:

DURANGO: Cerro Chupadero, 45 mi S of El Salto and just W of Pueblo Nuevo, humid oak-pine forest with mosses and mesophytic herbs abundant in thick humus, 2000–2500 m, 28 Jul 1955, *J. H. Maysilles 8214* (MICH, UC); steep, moist ravine on the edge of a steep-walled barranca, 2 mi W of Revolcaderos along route 40, 7100 feet, 8 Nov 1970, *D. E. Breedlove 18,922* (CAS/DS, UC).

This well-marked species was recognized as new on the basis of Maysilles' 1955 collection, but he obtained flowering material only. With its indistinct stylopodium, green flowers, and very slender pedicels, *A. filipes* does not resemble closely any other taxon known to us. Plants were successfully grown in the greenhouses of the University of California Botanical Garden, Berkeley, from seed from the Breedlove collection, but no fruit formed under cultivation.

Arracacia macvaughii Math. & Const., sp. nov. FIG. 3

Plantae graciles acaulescentes e radice tumida 10–30 cm altae, foliis glabris inflorescentia plus minusve scaberula; folia oblongo-ovalia 2–3-jugopinnata 2.5–5 cm longa 1.5–4 cm lata, foliolis oblongis orbiculatisve petiolulatis vel sessilibus dentatis vel lobatis 0.7–1.5 cm longis 0.5–1.5 cm latis; petioli graciles basi breviter scarioso-vaginantes 3.5–6 cm longi quam laminae longiores; pedunculi graciles adscendentes 7–24 cm longi quam folia longiores; involucrum plerumque nullum; radii fertiles 3–5 patenti-adscendentes inaequales scaberulosi 1–2 cm longi; involucelli bracteolae 1–5 lineares ad 4 mm longae; pedicelli fertiles 1–5 glabri 3–4 mm longi; flores albi, petalis anguste obovatis; stylopodium conicum, stylis gracilibus recurvatis, ovario glabro; carpophorum crassum bifidum; fructus ovato-lanceolatus apice attenuatus basi rotundatus, glaber, 3 mm longus 2–2.5 mm latus, costis filiformibus; vittae in intervallis et in commissuris plures; seminum superficies concava; chromosomatum numerus $n = 22$.

Slender, acaulescent, 10–30 cm tall from a swollen taproot, the foliage glabrous, the inflorescence a little scaberulous; leaves oblong-oval, 2.5–5 cm long, 1.5–4 cm broad, pinnate with 2 or 3 pairs of leaflets, the leaflets oblong to orbicular, 0.7–1.5 cm long, 0.5–1.5 cm broad, the larger (lower) petiolulate and pinnately lobed, the upper sessile and coarsely dentate to lobed, the lobes or teeth mucronulate; petioles slender, 3.5–6 cm long, longer than blade, shortly scarious-sheathing at base; peduncles 1 to several, slender, 7–24 cm long, ascending, exceeding leaves; involucre lacking, or occasionally of a single linear bract; fertile rays 3–5, spreading-ascending, unequal, 1–2 cm long, scaberulous; involucel of 1–5 linear bractlets up to 4 mm long, about equaling flowers but shorter than fruit; fertile pedicels 1–5, 3–4 mm long,

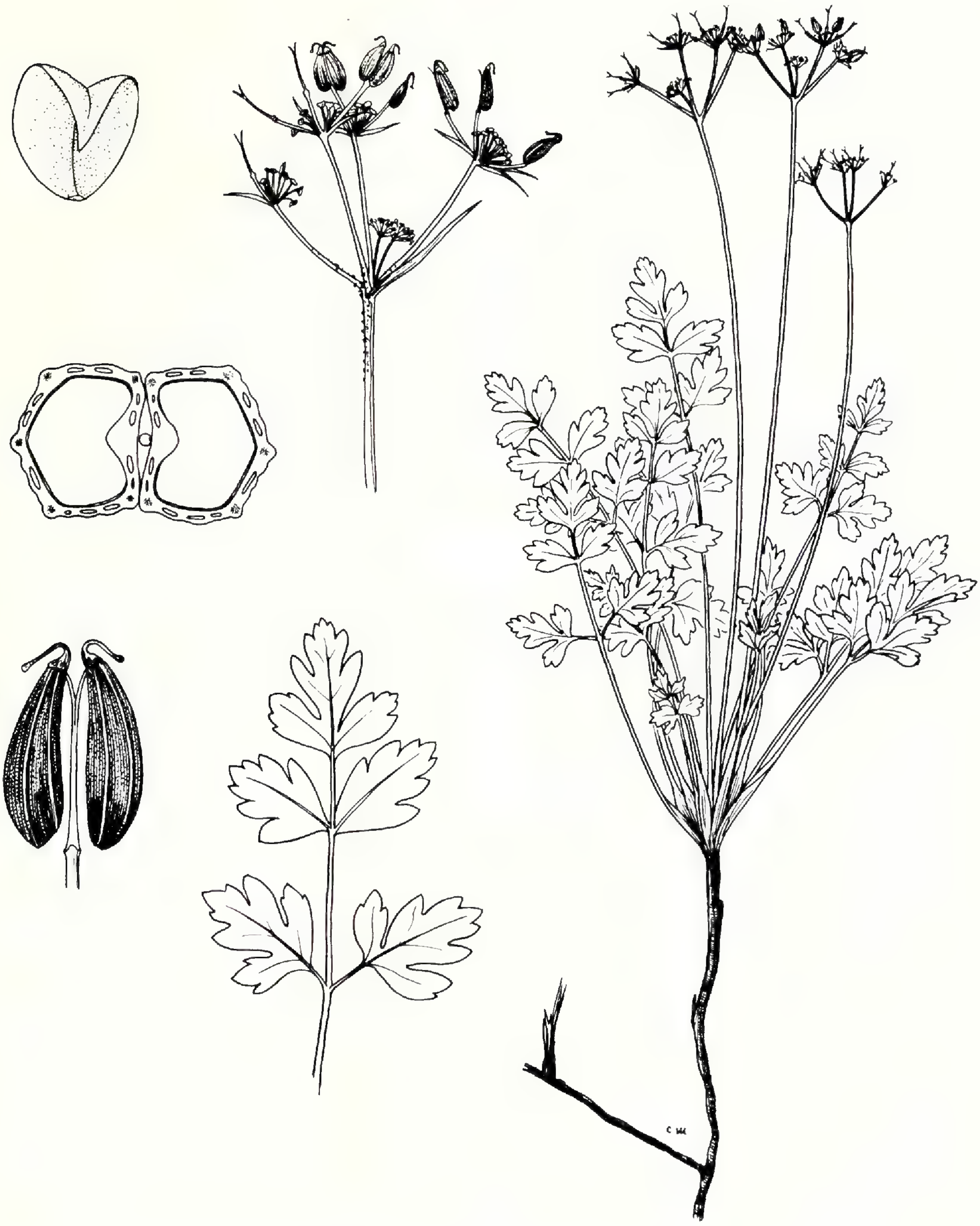

FIG. 3. *Arracacia macvaughii.* Habit, × 1/2; basal leaf blade, × 1; fruiting umbel, × 1½; petal, × 20; fruit, × 8; fruit transection, × 13 (all from the type).

glabrous; flowers white, the petals narrowly obovate; stylopodium conic, the styles slender, recurved, the ovary glabrous; carpophore stout, merely bifid at apex; fruit ovate-lanceolate, 3 mm long, 2–2.5 mm broad, tapering toward apex, rounded at base, glabrous, the ribs filiform; vittae several in intervals and on commissure; seed face concave; chromosome number $n = 22$.

TYPE: QUERETARO: Cerro Zamorano, Mpio. de Colón, 1 km al SW de la cumbre, elev. 3100 m, bosque de *Abies,* 13 Nov. 1971, *J. Rzedowski & R. McVaugh 409* (MICH, type).

Other collections examined:

QUERETARO: Type locality, 3 Aug 1972, *S. G. Weller 628* (UC).

With its low, acaulescent habit, thickened root, and particularly the shallowly divided carpophore, this species has the aspect of the genus *Tauschia,* to which the collectors tentatively referred it. However, the tapering fruit surmounted by a conical stylopodium necessitates its referral to *Arracacia,* where it most closely approaches the recently described *A. molseedii* Math. & Const. from Oaxaca.

Arracacia papillosa Math. & Const., sp. nov. FIG. 4

Plantae crassae caulescentes papilloso-hispidae vel papilloso-hispidulosae 0.85–1 m altae; folia basalia ignota; folia caulina inferiora ovato-deltoidea 18–20 cm longa 20–25 cm lata ternato-bipinnata, foliolis ovatis breve petiolatis sessilibusve 2–7.5 cm longis 1–4 cm latis minute serratis; petioli basales ignoti; petioli caulini inferiores late dilatati et scarioso-vaginantes; folia caulina ternata, superiora reducta; inflorescentia pauciramosa, pedunculis gracilibus 3–8 cm longis; involucrum nullum; radii fertiles 8–12 graciles patenti-adscendentes inaequales sparsim hispiduli 1.5–3 cm longi; involucelli bracteolae 5 vel 6 lineares papillosae 2–5 mm longae; pedicelli fertiles 1–5 patenti-adscendentes hispiduli; flores purpurei, petalis obovatis; stylopodium conicum, stylis brevibus divergentibus, ovario hispiduloso; carpophorum usque ad basim bipartitum; fructus ovoideus apice basique attenuatus 5–6 mm longus 3–4 mm latus, costis prominentibus subaequalibus anguste alatis hispidulosis; vittae magnae in intervallis 2 vel 3 in commissuris 2–4; semen sub vittis canaliculatum superficie involuta.

Stout, caulescent, 0.85–1 m tall, hispidulous-papillose; basal leaves not seen, the lower cauline leaves ovate-deltoid, 18–20 cm long, 20–25 cm broad, ternate-bipinnate, the leaflets ovate, acute to obtuse, rounded to subcuneate at base, distinct, short-petiolulate to sessile, 2–7.5 cm long, 1–4 cm broad, finely serrate; basal petioles not seen, the lower cauline broadly dilated and wholly scarious-sheathing; cauline leaves reduced upward, ternate with narrow divisions; inflorescence few branched, the peduncles slender, 3–8 cm long; involucre lacking; fertile rays 8–12, slender, spreading-ascending, unequal, 1.5–3 cm long, sparsely hispidulous; involucel of 5 or 6 linear, papillose bractlets 2–5 mm long, about equaling flowers but shorter than fruit; fertile pedicels 1–5, spreading-ascending, 3–7 mm long, hispidulous; flowers purplish, the petals obovate; stylopodium conic, the styles short, spreading, the ovary hispidulous; carpophore 2-cleft to base; fruit ovoid, 5–6 mm long, 3–4 mm broad, hispidulous on the narrowly and equally winged prominent ribs; vittae large, 2 or 3 in intervals, 2–4 on commissure; seed channeled under tubes, the face involute.

TYPE: JALISCO: Precipitous mountainside N of Lake Chapala, 3–5 km NE of San Juan Cozalá, abundant on N slopes in oak forest with heavy bunch-grass cover, elev. 2000–2300 m, 11 Sep 1967, *R. McVaugh 23,856* (MICH, type).

Other collections examined:

JALISCO: Zacatonales y zonas peñascosas, Cerro Viejo cerca de la cumbre, Mpio. de Tlajomulco, elev. 2950 m, 15 Aug 1970, *J. Rzedowski 27,550* (MICH).

The only described species of *Arracacia* with pubescent ovaries and fruit are *A. pubescens* H. Wolff from Hidalgo and *A. anomala* Math. & Const. from Chihuahua, and the plants under study do not closely resemble either of them. Aside from this feature, *A. papillosa* appears to resemble most closely *A. ovata* Coult. & Rose, known only from the Nelson collection made in Guerrero. Since this collection was obtained in December and the Rzedowski and McVaugh specimens in August and September, respectively, detailed comparison is difficult. However, the material of *A. ovata* shows no trace of the hispidulosity of the gynoecium, the leaves are merely puberulent on the veins beneath, and the whole plant is stouter and coarser with stouter peduncles, more numerous and longer rays, shorter pedicels, and narrower and longer fruit. We are indebted to the Smithsonian Institution for the opportunity to make the necessary comparison.

FIG. 4. *Arracacia papillosa.* Habit, × 1/6; lower cauline leaf, × 1/2; fruiting umbel, × 1; fruiting umbellet, × 6; fruit transection, × 12 (all from the type); flower, × 18; details of abaxial and adaxial leaf surface, × 2; detail of leaf papillosity, × 30 (all from *Rzedowski 27,550*).

Arracacia ebracteata (Rose) Math. & Const., comb. nov. FIG. 5

Coaxana ebracteata Rose, Contr. U.S. Nat. Herb. 8: 337. 1905.

Slender, caulescent, branching, from a woody base, 1–4 m high, glaucous and purplish, essentially glabrous; leaves triangular-ovate, 10–20 cm in diameter, bipinnate or ternate-pinnate, the leaflets ovate, the terminal acute to acuminate, cuneate to

FIG. 5. *Arracacia ebracteata.* Habit, × 1/8; part of basal leaf, × 1/2 (both from *Breedlove 7061, C-652*); umbellet, × 2; fruit, × 3 (both from *Breedlove 9262*); fruit transection, × 10 (from *Raven & Breedlove 20,057*).

truncate at base, the lower petiolulate, the upper confluent, 1.5–5 cm long, 1–3 cm wide, finely doubly spinulose-serrate and lobed toward base; petioles slender, 6–12 cm long, broadly sheathing at base; cauline leaves reduced upward, wholly sheathing with strongly inflated purplish sheaths; inflorescence branched, the peduncles 5–15 cm long; involucre wanting; fertile rays 2–10, slender, spreading, unequal, scaberulous, 2–6 cm long; involucel wanting; fertile pedicels 1–10, spreading, 2–5 mm long; flowers purplish-red, the petals obovate; stylopodium depressed but evident, the styles slender, spreading or recurved; carpophore 2-cleft to base, slender; fruit oblong-oval, 6–10 mm long, 3–4 mm broad, tapering to a truncate apex, rounded at base, glabrous, the ribs prominent, subequal, acute but unwinged; vittae unequal, usually several in intervals and on commissure; seed channeled under larger vittae, the face sulcate; chromosome number $n = 22$.

TYPE: CHIAPAS: "between Hurtztan [Huistán] and Oxchuc," 11 Mar 1896, *C. & E. Seler 2148* (US, type).

Other collections examined:

CHIAPAS: Forêts de pins de Pueblo nuevo, Oct 1839, Feb 1840, *J. Linden 586* (G, K, P; UC, photo); ridge near boundary of Chamula on road to Zinacantán, Mpio. Chamula, elev. 7500 feet, 17 Aug 1964, *D. E. Breedlove 7061* (CAS/DS; UC, cult. in U.C. Bot. Gard. as *C-650, 652*); slope with *Quercus* beside small lake near boundary of Mpios. Zinacantán and Chamula, trail from San Cristóbal de las Casas to Zinacantán Center, elev. 7800 feet, 11 Mar 1965, *Breedlove 9262* (CAS/DS, UC); slope with *Quercus,* trail to ridge N of Clínica Yerba Buena near Pueblo Nuevo Solistahuacán, Mpio. Pueblo Nuevo Solistahuacán, elev. 6000 feet, 25 Jan 1965, *P. H. Raven & D. E. Breedlove 20,057* (CAS/DS, UC); slope 3 km NW of Pueblo Nuevo Solistahuacán, elev. 5800 feet, 28 Jul 1970, *H. Zuill 203* (UC); pine-oak woods with ericaceous shrubs, among rocks in exposed part of woods, on route 190, 3.5 mi W of San Cristóbal de las Casas, elev. 2300 m, 10 May 1970, *Melinda Denton 1666* (MICH).

Although Rose's original description of this taxon omitted any characterization of the fruit, the habit is very reminiscent of that of *Coaxana purpurea* Coult. & Rose, the conspicuously flaring cauline leaf sheaths and flower color are similar, and it never occurred to us to question its generic placement. When we began to compare carefully the purple-flowered material of *Arracacia* with *Coaxana,* however, it became clear that two strikingly different expressions of fruit ribs were involved. If *Coaxana* is to be maintained as a distinct genus, we think it must be on this carpological basis. This necessitates transfer of Rose's species to *Arracacia.* It is interesting that the Linden collection in the Boissier Herbarium, Geneva, bears the determination "*Arracacia* indet." Since no complete description or any illustration has been provided hitherto, it seems appropriate to remedy that omission here.

Coaxana bambusioides Math. & Const., sp. nov. FIG. 6

Plantae crassae caulescentes purpurascentes praeter inflorescentiam papillosam glabrae 2.5–5 m altae; folia basalia ignota; folia caulina inferiora ovato-deltoidea 3 dm longa 4 dm lata ternato-bipinnata, foliolis ovato-lanceolatis petiolatis sessilibusve 1–4 cm longis 0.5–1.5 cm latis subtiliter spinoso-serratis; petioli basales ignoti; petioli caulini inferiores latissime dilatati purpurei; folia caulina superiora reducta; inflorescentia ramosa, pedunculis apice papillosis 10–20 cm longis; involucrum nullum; radii fertiles 30–45 graciles patentes inaequales papillosi 3–8 cm longi; involucellum nullum; pedicelli fertiles 2–12 patentes papillosi 5–10 mm longi; flores atropurpurei, petalis ovalibus; stylopodium conicum, stylis gracilibus patentibus recurvatisve; carpophorum ad basim bipartitum; fructus ovoideus 7–9 mm longus 4–6 mm latus glaber, 3 vel 4 costis in quoque mericarpio conspicue tenuialatis; vittae inaequales in intervallis 2–4 in commissuris plures; semen sub vittis depressum superficie sulcata; chromosomatum numerus $n = 22$.

Stout, caulescent, branching, 2.5–5 m high, purplish, glabrous except in inflorescence; basal leaves unknown, the lower cauline leaves triangular-ovate, 3 dm long, 4 dm broad, ternate-bipinnate, the leaflets ovate-lanceolate, the terminal acuminate, cuneate

FIG. 6. *Coaxana bambusioides*. Habit, × 1/2 (from *Rzedowski & McVaugh 247*); leaf margin, × 4; peduncle apex and base of rays, × 4; fruiting umbellet, × 1; fruit and carpophore, × 3; fruit transection, × 8 (all from type collection).

at base, the lower petiolulate, the upper confluent, 1–4 cm long, 0.5–1.5 cm wide, finely spinose-serrate, paler and reticulate beneath; basal petioles not seen; cauline leaves reduced upward, wholly sheathing with conspicuously inflated purplish sheaths; inflorescence branched, the peduncles 10–20 cm long, papillose at apex; involucre wanting; fertile rays 30–45, slender, spreading, unequal, papillose, 3–8 cm long; involucel wanting; fertile pedicels 2–12, spreading, papillose, 5–10 mm long; flowers

dark purple, the petals oval; stylopodium conical, the styles slender, spreading or recurved; carpophore 2-cleft to base, slender; fruit ovoid, 7–9 mm long, 4–6 mm broad, glabrous, 1 or 2 of dorsal and 2 lateral ribs of each mericarp conspicuously thin-winged; vittae unequal, 2–4 in intervals, several on commissure; seed depressed under larger vittae, the face sulcate; chromosome number $n = 22$.

TYPE: GUERRERO: Cloud forest of *Pinus, Abies,* and *Lobelia* with abundant epiphytes, SW slope of Cerro Teotepec near summit, elev. 10,750 feet, 21 Jul 1969, *Theodore F. Niehaus, R. W. & Diane Cruden 901* (UC, type).

Other collections examined:

GUERRERO: Pine forest, Teotepec, Distr. Galeana, elev. 3220 m, 25 Dec 1937, *G. B. Hinton et al. 11,128* (G, K, NY, P, UC, US–distributed as *Angelica polymorpha* C. & R.); vertiente SW del Cerro Teotepec, Mpio. de Tlacotepec, elev. 2920 m, 29 Jan 1965, *J. Rzedowski & R. McVaugh 247* (ENCB).

The genus *Coaxana,* as indicated above (p. 13), was based upon *C. purpurea* from Oaxaca, a species that has been found subsequently also in Guatemala. *Coaxana ebracteata* Rose, the second species, although vegetatively very similar, has proven to be an *Arracacia* now that ripe fruit is available for comparison. The present taxon, which has been long known to the authors through the Hinton collection, proves to have fruit almost identical with the very distinctive fruit of the type species, that is with the costae of the two mericarps unequally winged. *Coaxana bambusioides* differs from *C. purpurea* by its larger and more dissected leaves, much more conspicuous leaf sheaths, papillose peduncles, rays and pedicels, more numerous and unequal rays, conical stylopodium, and lack of an involucel. Hinton referred to the plant as having a purple bamboo-like stalk, hence the specific epithet.

Prionosciadium bellii Math. & Const., sp. nov. FIG. 7

Plantae validae inflorescentia foliisque scaberulis vel villosis vel glabratis 2–3 m altae; folia basalia ovata bipinnatifida diametro ca 4 dm, foliolis lanceolatis acuminatis subtiliter duplo-serratis plerumque basi lobatis 1–8 cm longis 1–3 cm latis sinubus angustis rhachidi serrato-alata confluentibus; petioli supra basim vaginantem breve alati ca 2 dm longi; folia caulina opposita verticillatave pinnata vel ternata vel ternato-pinnato-decomposita vaginis brevibus angustisque, foliolis elongato-angustis petiolatis; pedunculi crassi verticillati 3–8 cm longi; involucri bracteae plures vel unica, filiformae, usque ad 1 cm longae vel obsoletae; radii fertiles 10–35 patentes subaequales 1–4 cm longi; involucellorum bracteolae 2–5, lineares filiformesve, flores subaequantes quam fructus breviores; pedicelli fertiles 1–7, 3–5 mm longi; flores atropurpurei vel flavo-virides, ovario glabro; fructus late ovalis apice rotundatus basi leviter retusus glaber 10–12 mm longus 7–9 mm latus, costis dorsalibus prominentibus peranguste alatis, lateralibus late tenuialatis alis corpus subaequantibus; vittae in intervallis 2 vel 3 in commissuris 4–6; seminum superficies involuta; chromosomatum numerus $n = 21$.

Plants stout, 2–3 m high, the inflorescence ± scaberulous, the juvenile foliage decidedly villous, scaberulous on veins beneath to glabrate; basal leaves ovate, ca 4 dm long and broad, bipinnatifid, the leaf divisions lanceolate, acuminate, 1–8 cm long, 1–3 cm broad, finely doubly serrate and often lobed toward base, the sinuses narrow, confluent by a similarly serrate winged rachis; petiole winged above the short, sheathing base, ca 2 dm long; cauline leaves opposite or whorled, pinnate or ternate or ternate-pinnately decompound, the sheaths becoming small and narrow, the elongate-acuminate leaflets petiolulate; inflorescence of successive whorls of stout peduncles 3–8 cm long, each of the lateral subtended by a pair of leaves; involucre of 1 to several filiform bracts up to 1 cm long, or wanting; fertile rays 10–35, spreading, subequal, 1–4 cm long; involucel of 2–5 linear or filiform bractlets about equaling flowers but usually shorter than fruit; fertile pedicels 1–7, 3–5 mm long; flowers reddish-purple or greenish-yellow, the ovary glabrous; fruit broadly oval, 10–12 mm

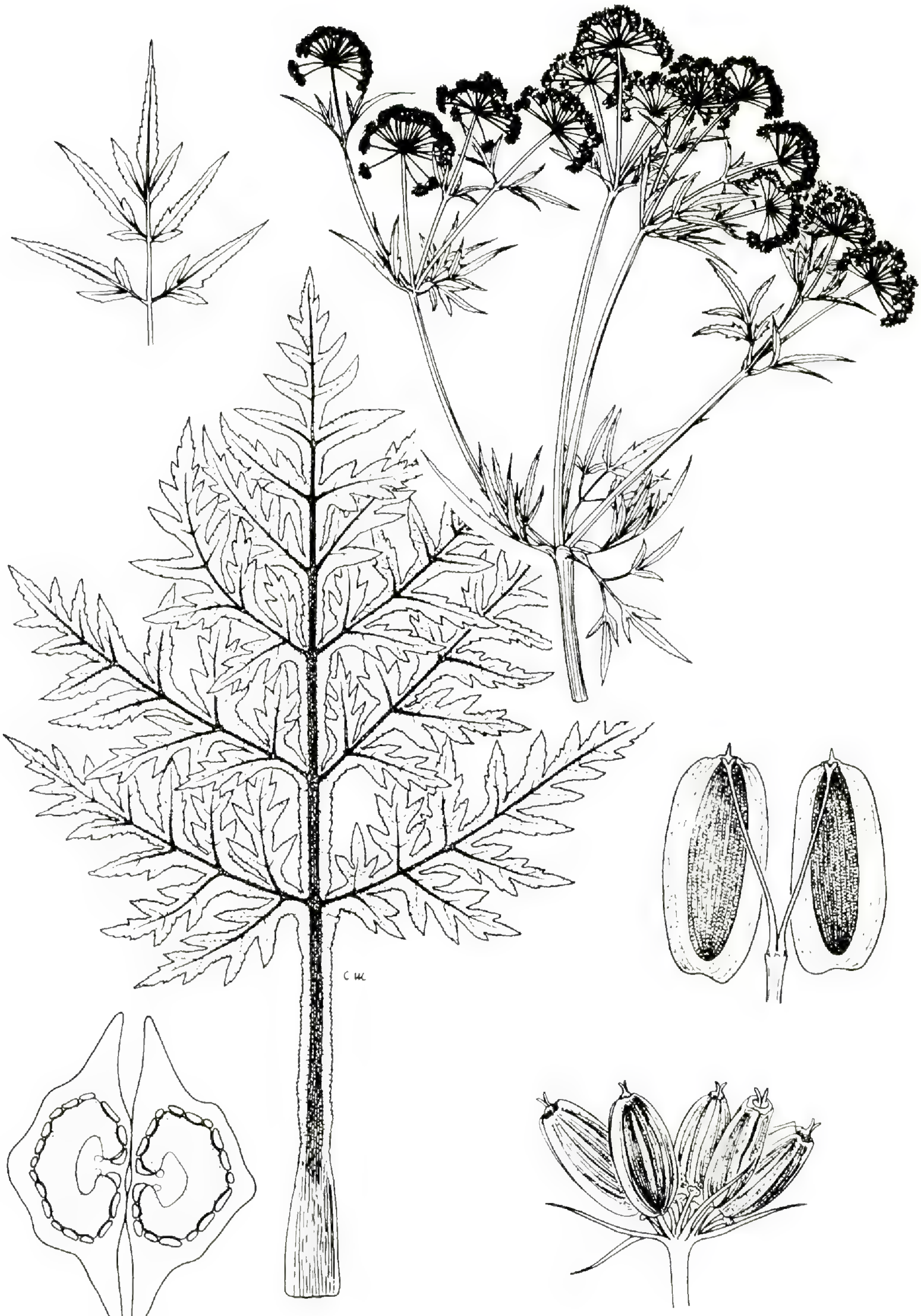

FIG. 7. *Prionosciadium bellii.* Basal leaf, × 1/4 (from *Molseed & Rice 230*); part of inflorescence, × 1/4 (from *Pilz & Strother 669*); part of cauline leaf, × 1/2 (from *Bell & Duke 16,729*); umbellet, × 2; fruit, × 3; fruit transection, × 6 (all from type collection).

long, 7–9 mm broad, rounded at apex, a little retuse at base, glabrous, the dorsal ribs prominent to very narrowly winged, the lateral broadly thin-winged, the wings about equaling body; vittae 2 or 3 in intervals, 4–6 on commissure; seed dorsally compressed in transection, scarcely channeled, the face involute; chromosome number $n = 21$.

TYPE: MICHOACAN: Brushy roadside on route 15, 13.3 mi N of km 165 in center of Zitácuaro, elev. ca 6500 feet, 23 Aug 1959, *C. Ritchie Bell & James A. Duke 16,731* (NCU, type; UC, isotype).

Other collections examined:

MICHOACAN: Along rocky cut above and below route 15 just E of bridge near river 0.9 mi NW of Turundeo, near Tuxpan, elev. ca 7000 feet, 22 Aug 1959, *Bell & Duke 16,729* (NCU, UC); SW-facing rock and talus slope at El Salto on route 15, 0.1 mi E of Temescal, 0.5 mi W of La Pol Villa (E of Morelia), elev. ca 8100 feet, 22 Aug 1959, *Bell & Duke 16,712* (NCU, UC); undergrowth in more open areas in forest on steep cliff, Los Cantiles, km 287 on route 15 (ca 26 km E of Morelia), 14 Jul 1963, *Molseed & Rice 230* (UC); 4 mi E of Tuxpan along Morelia-Toluca highway, route 15, elev. ca 6200 feet, growing in thick shrubby vegetation above roadcut, 2 Jul 1971, *Pilz & Strother 669* (UC); route 15, 5 mi N & W of Tuxpan, near Puente Río Turundeo, elev. 1850 m, weedy roadside banks, 3 Aug 1968, *W. R. & C. Anderson 5000* (MICH, UC).

In our key (Math. & Const. 1944–45, pp. 205–206) this taxon would be identified with *P. townsendii* Rose and *P. diversifolium* Rose. From the latter *P. bellii* differs in its finely serrate and much narrower leaf divisions, more numerous rays, flower color, and larger fruit. The similarity to the Chihuahuan *P. townsendii* is much greater; in general, the Chihuahuan plant can be distinguished by its glabrous foliage, fewer rays, and smaller and narrower fruit, in addition to its much more northerly distribution. However, the larger cauline leaves, which are decompound and lack a winged rachis, are often the only conspicuous foliage when the plant is in fruit. These give *P. bellii* a closer resemblance to *P. linearifolium* (S. Wats.) Coult. & Rose and *P. watsoni* Coult. & Rose, from which it differs by its apparently quite different basal leaves, more numerous rays, and differently proportioned mericarps. *Molseed & Rice 230* served as the voucher specimen for the published chromosome number of $n = 21$ for *Prionosciadium megacarpum* C. & R. (Bell & Constance, 1966), and this unusual count was confirmed by *Pilz & Strother 669*. The chromosome number of the true *P. megacarpum* remains to be determined.

Prionosciadium lilacinum Math. & Const., sp. nov. FIG. 8

Plantae validae foliis inflorescentiisque glaucis scaberulis vel hispidulis 2–4 m altae; folia basalia ovata ternato-pinnata diametro 3–3.5 dm, foliolis ovatis apice abrupte acutis vel obtusis basi cuneatis grosse duploserratis interdum lobatis scaberulis vel hispidulis, 6–10 cm longis 3–6 cm latis sinubus angustis rhachidi lata integra vel sparsim serrato-alata leniter vaginanti; petioli 2–2.5 dm longi ei foliorum caulinorum omnino vaginantes; folia caulina opposita ternata, divisionibus elongato-lanceolatis acuminatis rhachidi sensim alata vagina inconspicua; pedunculi graciles oppositi vel verticillati 3–10 cm longi; involucrum deficiens; radii fertiles 5–8 patentes inaequales 1–2 cm longi; involucellorum bracteolae 5 vel 6 lanceolatae acuminatae glabrae quam flores longiores quam fructus breviores 5–6 mm longae; pedicelli fertiles 2–5, 2–3 mm longi; flores lilacino-purpurei, sepalis visibilibus, ovario glabro; fructus ovoideus apice rotundatus basi retusus glaber 6–9 mm longus 5–7 mm latus, costis dorsalibus filiformibus eis lateralibus quam corpore latioribus; vittae in intervallis 2 vel 3 in commissuris plures; seminum superficies sulcata vel involuta; chromosomatum numerus $n = 22$.

Plants stout, 2–4 m high, glaucous, the foliage and inflorescence scaberulous to hispidulous; basal leaves ovate, 3–3.5 dm long and broad, ternate-pinnate, the leaflets ovate, abruptly acute to obtuse, cuneate at base, 6–10 cm long, 3–6 cm broad, coarsely doubly serrate, the larger lobed, scaberulous to hispidulous on veins beneath,

FIG. 8. *Prionosciadium lilacinum*. Leaf, × 1/2; inflorescence, × 1/2; abaxial leaf surface, × 3; umbellet, × 2 (all from *Cruden 1050*); fruit, × 3; carpophore, × 3; fruit transection, × 9 (all from *Weller 685*).

the sinuses narrow, confluent by the broad, entire or sparsely serrate winged rachis; petioles 2–2.5 dm long, the cauline petioles wholly sheathing; uppermost cauline leaves opposite, ternate with elongate lanceolate-acuminate divisions, weakly winged rachis, and inconspicuous sheaths; inflorescence of several pairs or whorls of peduncles, the peduncles slender, 3–10 cm long, subtended by opposite leaves; involucre wanting; fertile rays 5–8, spreading, unequal, 1–2 cm long; involucel of 5 or 6 lanceolate, acuminate, glabrous bractlets 5–6 mm long, longer than flowers but shorter than fruit;

fertile pedicles 2–5, 2–3 mm long; flowers lilac-purple, the sepals evident, the ovary glabrous; fruit ovoid, rounded at apex, retuse at base, 6–9 mm long, 5–7 mm broad, glabrous, the dorsal ribs filiform, the lateral wings broader than body; vittae 2 or 3 in intervals, several on commissure; seed flattened dorsally, the face sulcate to involute; chromosome number $n = 22$.

TYPE: JALISCO: Common along weedy roadside in full sun, 13.3 mi E of Jalisco-Nayarit border on route 15 [i.e., near Plan de Barrancas], elev. 3300 feet, 18 Aug 1972, *Stephen G. Weller 682* (UC, type).

Other collections examined:

NAYARIT: Route 15, 2 mi S of Ocotillo (27 mi SE of Tepic), 12 Jul 1963, *Molseed & Rice 217* (UC); among rocks, route 15, 0.4 km N of km 931, ca 26 km NW of Tepic, 12 Jul 1966, *R. W. Cruden 1050* (UC); route 15 at Jalisco border, 17 Jul 1971, *Strother & Pilz 1069* (UC); 15 mi NW of Tepic, 19 Aug 1972, *Weller 685* (UC).

Prionosciadium lilacinum appears to be closest to *P. cuneatum* Coult. & Rose, with which it shares the characters of a winged foliar rachis, abruptly acute leaflets, an evident calyx, and lilac-purple flowers. It differs from this species, however, in its broader, doubly serrate, and differently shaped leaflets, less strongly winged rachis, fewer rays, broader and longer bractlets, smaller and differently shaped fruit, and less prominent dorsal fruit ribs. In foliage it is most like *P. diversifolium* and shows comparable variability. However, in *P. lilacinum* the cauline leaves are wholly sheathing, the rays are glabrous, and the green bractlets are differently shaped.

Rhodosciadium rzedowskii Math. & Const., sp. nov. FIG. 9

Plantae graciles glaucae glabrae ad basim umbellarum tantum parum puberulentae ex basi tuberosa 0.8–1 m altae; folia basalia ovata ternato-pinnato-decomposita 6–20 cm longa 8–10 cm lata, divisionibus ultimis linearibus, 5–50 mm longis 1–3 mm latis, eis terminalibus elongato-attenuatis regulatim dentatis basin versus lobatis, eis distalibus confluentibus, rhachidi primaria exalata; petioli basi late scarioso-vaginantes 4–8 cm longi; folia caulina alterna oppositave ternata, vagina parva dilatata instructa; pedunculi plures verticillati 3–5 cm longi; involucrum nullum; radii fertiles 3–5 patenti-adscendentes subaequales 1–1.5 cm longi; bracteolae involucellorum 2–5 lineari-filiformes quam fructus breviores 2–4 mm longae; pedicelli fertiles 1–5, ca 2 mm longi; flores flavi, stylis ca 1 mm longis, ovario glabro; fructus ovalis orbiculatusve glaber, apice rotundatus basi retusus, 8–11 mm longus 6–8 mm latus, costis dorsalibus filiformibus eis lateralibus late tenuialatis alis quam corpore latioribus; vittae parvae in intervallis 3 vel 4 in commissuris 6–8; semen dorsaliter compressum vix canaliculatum superficie involuta.

Plants slender, 0.8–1 m high, glabrous and glaucous, a little puberulent at base of umbels, from a tuberous base; basal leaves ovate, 6–20 cm long, 8–10 cm broad, ternate-pinnately decompound, the ultimate divisions linear, 0.5–5 cm long, 1–3 mm broad, the terminal elongate-attenuate, regularly dentate to lobed toward base, the distal confluent, but the primary rachis unwinged; petiole 4–8 cm long, broadly scarious-sheathing at base; cauline leaves alternate or opposite, ternate, with a small, broadly flaring sheath; inflorescence of several verticels of slender peduncles, 3–5 cm long, subtended by a single reduced leaf; involucre wanting; fertile rays 3–5, spreading-ascending, subequal, 1–1.5 cm long; involucel of 2–5 linear-filiform bractlets 2–4 mm long, shorter than fruit; fertile pedicels 1–5, ca 2 mm long; flowers yellow, the styles ca 1 mm long, the ovary glabrous; mature fruit oval to orbicular, rounded at apex, retuse at base, 8–11 mm long, 6–8 mm broad, glabrous, the dorsal ribs filiform, the lateral broadly thin-winged, the wings broader than body; vittae small, 3 or 4 in intervals, 6–8 on commissure; seed dorsally compressed in transection, scarcely channeled, the face involute.

TYPE: SAN LUIS POTOSI: Rocky limestone, San Pedro, Sierra Madre Oriental, elev. 2150–2200 m, 29 Jul 1934, *Francis W. Pennell 17,734* (UC, type).

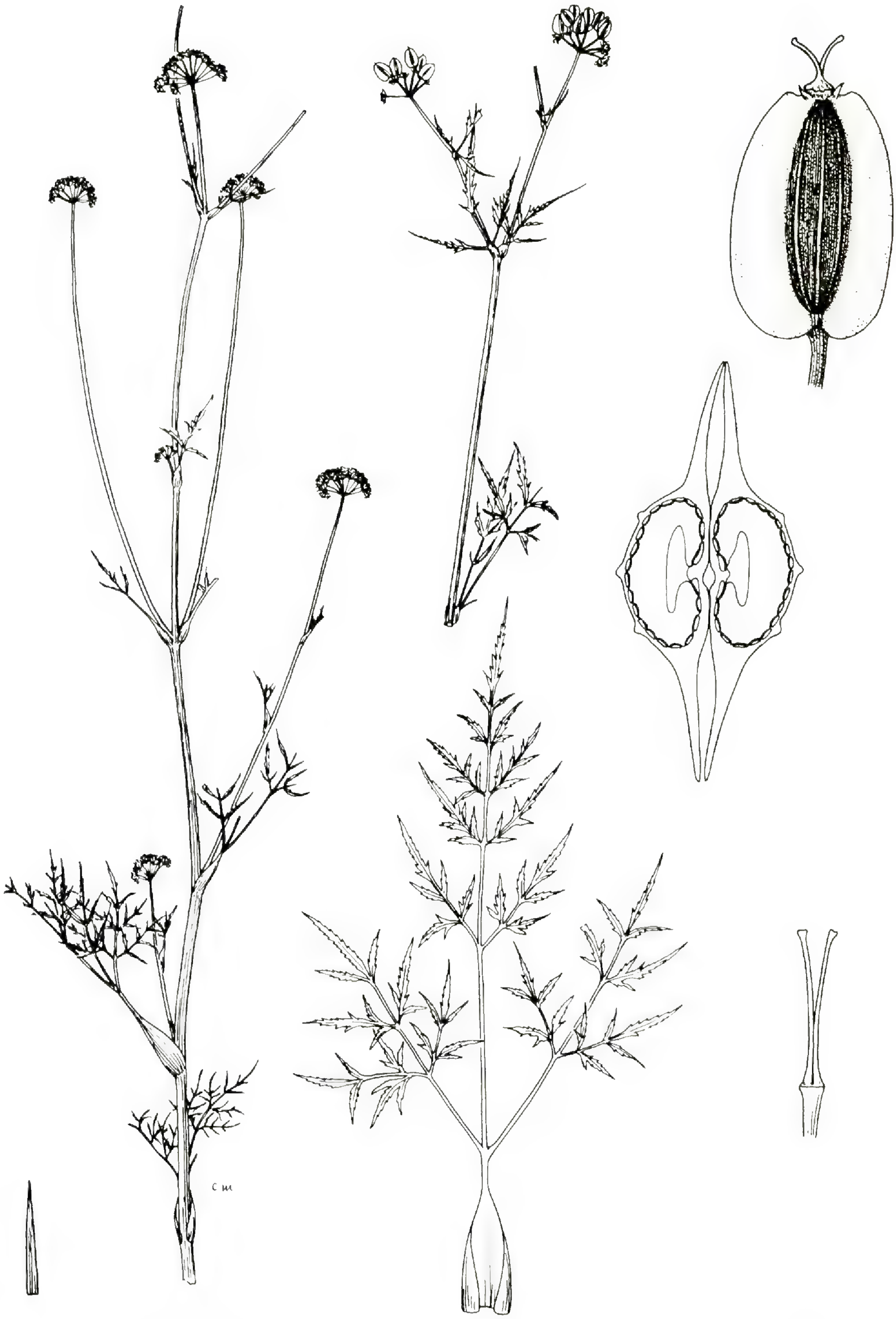

FIG. 9. *Rhodosciadium rzedowskii.* Habit, × 1/4; lower cauline leaf, × 1/2; carpophore, × 3; bractlet, × 5; fruit, × 3; fruit transection, × 8 (all from *Rzedowski 3381, 6198*).

Other collections examined:

SAN LUIS POTOSI: Encinar chaparro sobre cerro riolítico, Villa de Arriaga, elev. 2200 m, 5 Aug 1954, *J. Rzedowski 3381* (UC); ladera riolítica con vegetatión de zacatal, Sierra de San Miguelito, al W de Terrero, elev. 2050 m, *Rzedowski 6198* (ENCB, UC).

This and the following species, which are much more similar to each other than to any other members of *Rhodosciadium,* have been overlooked partly because of the difficulty of correlating flowering and fruiting material and thus of making assignment to the proper genus. The type of *R. rzedowskii,* for example, was one of the several elements we (Mathias & Constance, 1944–45, p. 210) combined and cited under *Prionosciadium watsoni* Coult. & Rose. The two new taxa may be distinguished from each other as follows:

Plants glaucous and glabrous; flowers yellow; fruit 8–11 mm long, 6–8 mm broad; vittae small, 3 or 4 in intervals; seed face involute; San Luis Potosí. *R. rzedowskii.*

Plants not glaucous, a little scaberulous; flowers lilac; fruit 5–8 mm long, 4–6 mm broad; vittae rather large, 1 or 2 in intervals; seed face plane; Jalisco. *R. macvaughiae.*

Rhodosciadium macvaughiae Math. & Const., sp. nov. FIG. 10

Plantae graciles glabrae foliis inflorescentiaque parum scaberula 0.4-1 m altae; folia basalia deltoideo-ovata ternato-pinnato-decomposita diametro 5–15 cm, divisionibus ultimis linearibus 1–15 mm longis vix 1 mm latis, eis terminalibus elongatis integris eis distalibus confluentibus rhachidi primaria exalata; petioli anguste vaginantes 4–9 cm longi; folia caulina alterna vel opposita insuper gradatim ternata vel integra, segmentis elongatis et inconspicue vaginantibus; pedunculi graciles alterni verticillative 4–10 cm longi; involucrum nullum; radii fertiles 2–5 patenti-adscendentes subaequales 2–3(–4) cm longi; bracteolae involucellorum 1–3 lineari-filiformes quam fructus breviores 1–4 mm longae; pedicelli fertiles 1–3, 1.5–2.5 mm longi; flores lilacini, stylis ca 1 mm longis, ovario glabro; fructus ovalis orbiculatusve apice rotundatus basi retusus glaber 5–8 mm longus 4–6 mm latus, costis dorsalibus filiformibus eis lateralibus late tenuialatis alis quam corpore latioribus; vittae magnae 1 vel 2 in intervallis in commissuris 8; semen dorsaliter compressum vix canaliculatum superficie plana.

Plants slender, 0.4–1 m high, glabrous, the foliage and inflorescence a little scaberulous; basal leaves deltoid-ovate, 5–15 cm in diameter, ternate-pinnately decompound, the ultimate divisions linear, 1–15 mm long, less than 1 mm broad, the terminal elongate, entire, the distal confluent, but the primary rachis unwinged; petiole 4–9 cm long, rather narrowly sheathing; cauline leaves alternate to opposite, the uppermost ternate to entire with elongate segments and inconspicuous sheaths; inflorescence of slender peduncles alternate below, verticillate above, 4–10 cm long; involucre wanting; fertile rays 2–5, spreading-ascending, subequal, 2–3(–4) cm long; involucel of 1–3 linear-filiform bractlets 1–4 mm long, shorter than fruit; fertile pedicels 1–3, 1.5–2.5 mm long; flowers lilac (bluish-pink), the styles ca 1 mm long, the ovary glabrous; mature fruit oval to orbicular, rounded at apex, retuse at base, 5–8 mm long, 4–6 mm broad, glabrous, the dorsal ribs filiform, the lateral broadly thin-winged, the wings broader than body; vittae rather large, 1 or 2 in intervals, 8 on commissure; seed dorsally compressed in transection, scarcely channeled, the face plane.

TYPE: JALISCO: Abundant, upper slopes of Cerro Tequila about 10 km S of Tequila, steep mountainside in mature oak forest with many epiphytes, elev. 2400–2800 m, 14 Sep 1967, *R. McVaugh 23,905* (MICH, type; UC).

Other collections examined:

JALISCO: Bosque de *Pinus* y *Quercus,* Cerro de Tequila, elev. 2750 m, 11 Aug 1968, *L. M. Villarreal de Puga 1622* (ENCB); bosque de encino en ladera de cerro, Cerro de Tequila, Mpio. de Tequila, elev. 2750 m, 13 Jul 1971, *R. González T. 224* (MICH); type locality, 18 Aug 1972, *S. G. Weller 680* (UC).

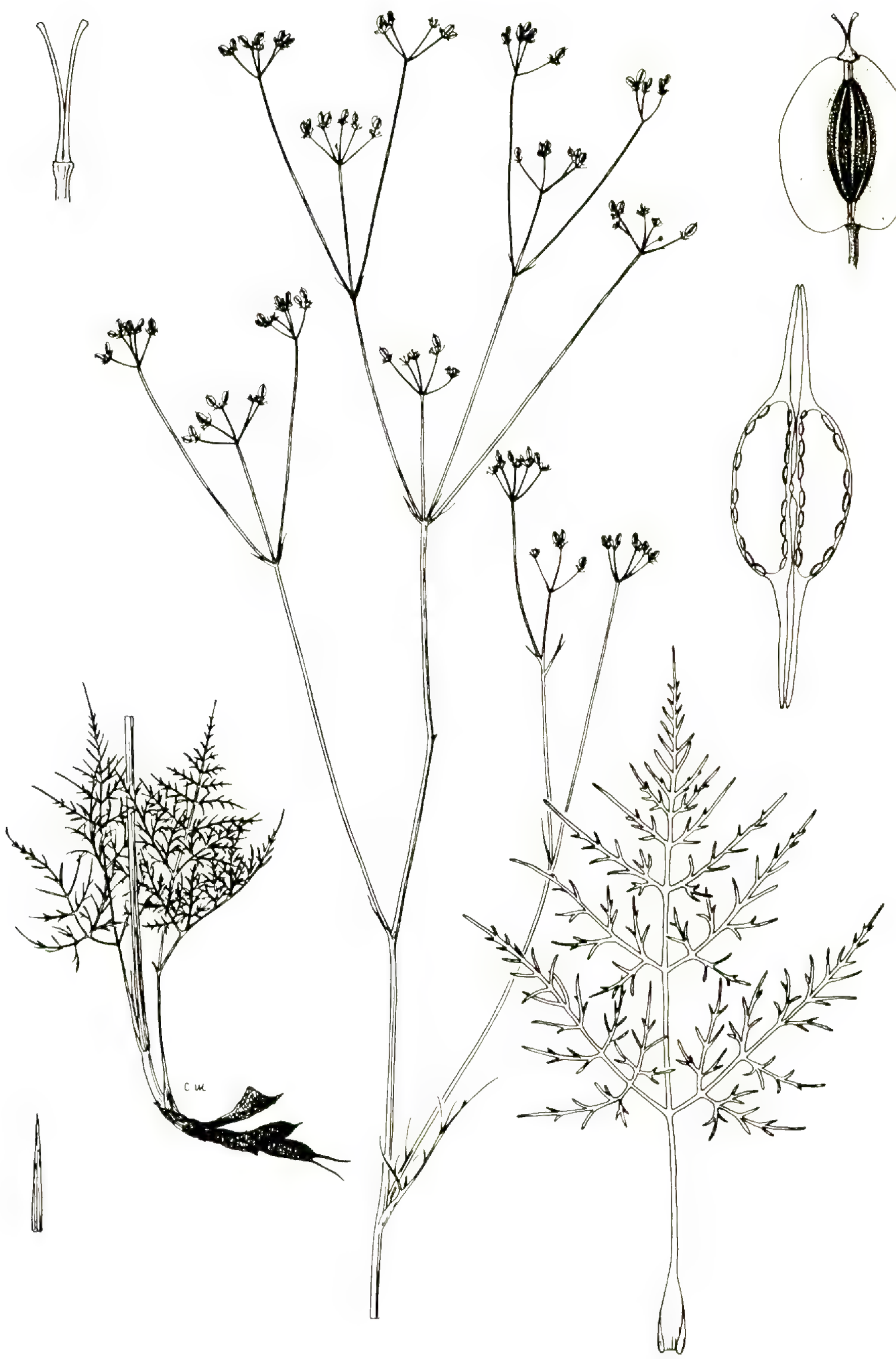

FIG. 10. *Rhodosciadium macvaughiae*. Habit, × 1/4; basal leaf, × 1/2; carpophore, × 3; bractlet, × 5; fruit, × 3; fruit transection, × 9 (all from type collection).

We are happy to dedicate this attractive plant to Ruth Beall McVaugh, who has been an active participant in her husband's Mexican floristic studies.

Eryngium jaliscense Math. & Const., sp. nov. FIG. 11

Plantae perennes graciles caulescentes 8–14 dm altae ex caudice verticali, scapo solitario erecto simplici; folia basalia numerosa disticha lineari-acuminata 25–55 cm longa 2–8 mm lata, margine tota setoso-ciliata densissime prope basin, setis basalibus quam latitudine foliorum multo longioribus, venis parallelis, vaginis latitudine laminae aequantibus 2–4 cm longis; folia caulina basalibus similia alterna reductaque; inflores-

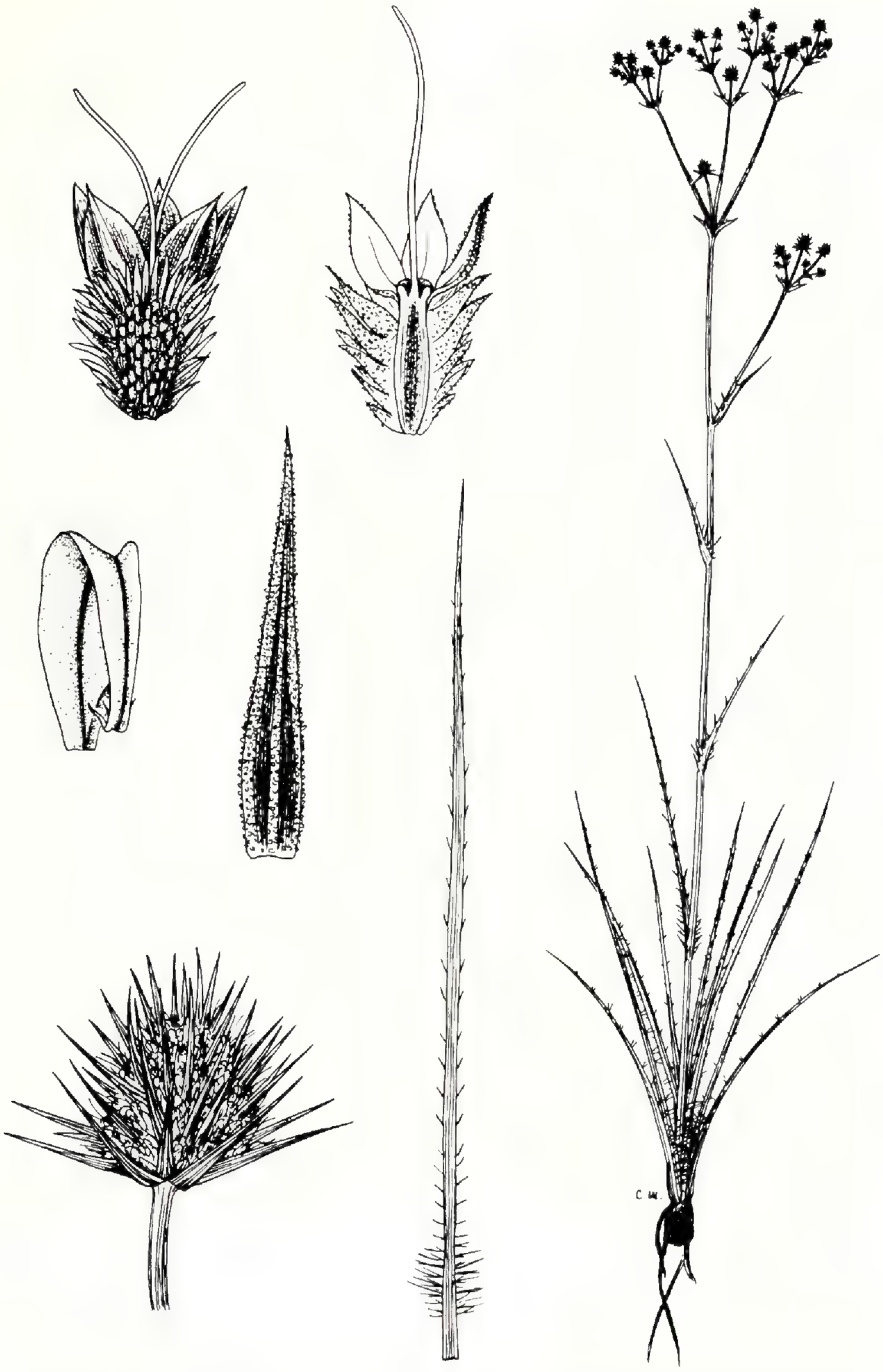

FIG. 11. *Eryngium jaliscense*. Habit, × 1/8; basal leaf, × 1/4; fruit, commissural view, × 12 (all from *Feddema 2189*); head, × 2; petal, × 25; fruit, dorsal view, × 12; bractlet, × 10 (all from type collection).

centia dichotomo-cymosa ramosa; capitula globoso-ovoidea usque ad hemisphaerica pedunculata viridi-alba diametro 8–10 mm, floribus numerosis; bracteae involucrales 5 vel 6 rigidae ovato-acuminatae integrae 5–7 mm longae, 1.5–2 mm latae quam capitulum breviores; bracteae florales eis involucralibus similes scarioso-marginatae valde puberulentes fructum multo excedentes; sepala ovata apiculata puberulenta 1–1.5 mm longa; petala oblonga 1 mm longa apice fimbriata; styli graciles 3 mm longi quam calyces duplo longiores; fructus ovoideus diametro 1.5–2 mm, superficiebus mericarpiorum papillatis, squamis lateralibus calyciniisque integris.

Plants slender caulescent perennials 8–14 dm high from a short vertical caudex bearing fleshy-fibrous roots, the stem solitary, erect, unbranched below inflorescence; basal leaves numerous, distichous, linear-acuminate, 25–55 cm long, 2–8 mm broad, acuminate at apex, setose-ciliate throughout, densely so at base, some auxiliary setae present, the basal setae much longer than leaf width, the venation parallel, the sheaths as broad as blades, 2–4 cm long; cauline leaves few, like basal, alternate, reduced; inflorescence dichotomously cymose, the heads rather small, numerous, pedunculate, the flowers numerous; heads globose-ovoid to hemispheric, greenish-white, 8–10 mm in diameter; involucral bracts 5 or 6, rigid, spreading-ascending, ovate-acuminate, 5–7 mm long, 1.5–2 mm broad, acuminate, entire, puberulent, shorter than heads; bractlets like bracts in size and shape, scarious margined, strongly puberulent, much longer than fruit; sepals ovate, 1–1.5 mm long, apiculate, puberulent; petals oblong, ca 1 mm long, with a narrower fimbriate tip; styles slender, ca 3 mm long, twice as long as sepals; fruit ovoid, 1.5–2 mm long and broad, the calycine and marginal squamae flattened, lanceolate, the dorsal faces densely papillate.

TYPE: JALISCO: Occasional, eastern foothills of the Sierra del Halo, ca 25 km W of Jilotlán de los Dolores (56 km from road-junction 11 -12 km SW of Tecalitlán) in pine forest, deep sandy granitic soils in stream valley, elev. 1600 m, 21–21 Nov 1970, *R. McVaugh 25,559* (MICH, type).

Other collections examined:

JALISCO: Common on shaded lower slopes, Barranca de San Juan de Dios, ca 15 km E of Pihuamo, E slopes of Sierra de los Corales, Mpio. de Tecalitlán, elev. 1200 1300 m, 24 Oct 1963, *C. Feddema 2189* (MICH, UC).

This undoubtedly is closest to *E. pringlei* Hemsl. & Rose of San Luis Potosí, with which it agrees in the distichous, setose-ciliate foliage, the strongly puberulent heads, and details of flowers and mericarp ornamentation. It differs strikingly by its larger size, longer and differently shaped leaves (which are prominently setose throughout), and by its much larger, more acuminate, and very prominent bracts and bractlets, which give the much more numerous heads an entirely different aspect. *Eryngium pringlei* is reported to occur in alkaline meadows and salt marshes at lower altitudes while *E. jaliscense* is known from forested slopes at slightly higher elevations. Fruiting material of *E. pringlei* has been collected from June to early August; *E. jaliscense* appears not to fruit until late October or November.

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Volume 11, No. 2, pp. 25–96, 23 figures in text

Early issues of the Contributions were published as Numbers 1–8, from 1939 to 1942; the title page and cumulative index were issued in 1966. Other volumes were published, as follows:

Vol. 9, no. 1	30 Sept. 1966
Vol. 9, no. 2	1 Dec. 1969
Vol. 9, nos. 3–7	30 Mar. 1972
Vol. 9, no. 8	31 Aug. 1972
Vol. 10	18 Sept. 1973
Vol. 10 (corrected printing)	10 Jan. 1974
Vol. 11, no. 1	7 Nov. 1973
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Contr. Univ. Mich. Herb. 11(2):25–40. 1975.

MARASMIUS SECTION CHORDALES IN THE NORTHEASTERN UNITED STATES AND ADJACENT CANADA[1]

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Although neotropical and European species of *Marasmius* have been comprehensively studied in recent years (*e.g.*, 6, 13, 16, 17), there are few modern descriptions of North American species. Early North American treatments, all based primarily on macroscopic characters, include those of Morgan (9), Pennington (10), and Kauffman (2). Kühner's (4, 5) classification scheme as modified by Singer (12, 14, 15) provides an excellent modern framework for the study of *Marasmius* and has been followed here. The present work consists of a key and descriptions for the six species of *Marasmius* section *Chordales* Fr. known to occur in the northeastern United States and adjacent Canada.

Marasmius section *Chordales* Fr. (=*M.* section *Alliacei* Kühner 1933) includes species whose pilei have hymeniform cuticles of smooth or occasionally nodulose cells, whose stipes are non-insititious (*i.e.*, there are hairs at the point of emergence from the substrate), and whose trama is nonamyloid. A partial, adnate collar may sometimes occur, but there is never a complete, free collar to which the lamellae are attached. Hyaline, capitate or appendiculate pileocystidia are present in some species. Usually the pilei are, for *Marasmii*, medium in size (*ca* 3–30 mm broad). An odor of garlic or onions is sometimes present. Species with broom cells of the *Rotula*- or *Siccus*-type are not placed in this section. Young pilei of *M. scorodonius* (Fr.) Fr. and both young and old pilei of *M. olidus* Gilliam and *M. insipidus* Gilliam, however, may have nodulose or apically diverticulate cuticular cells which fall under the definition of broom cells. Careful investigation of radial sections of pilei of *M. scorodonius* show a few such cells in every collection, although the cells in tangential section are usually all smooth. In primordia the entire surface may be formed of nodulose cells. If nodulose broom cells are present, the combination of nonamyloid trama, collarless lamellae, absence of black rhizomorphs, and non-insititious stipe will still indicate *M.* sect. *Chordales*.

Singer's (12,14) disposition of Fries' sections of *Marasmius* designed to preserve the widely-used sectional names of Kühner (1933) has proved to be practical and desirable, particularly since many of the type species on which the sections are based have remained poorly understood. The type species of *M.* section *Chordales* Fr. (*M. chordalis* Fr., according to Article 22 of the *International Code of Botanical Nomenclature*), however, is well understood. Kühner (4) cited it in the original description of his section *Alliacei* ("*Alliateae*"). In the spirit of Singer's (12) substitution of the name *Marasmius* for Kühner's section *Rotulae* on nomenclatural grounds, I have used the Friesian name *Chordales* for this section while preserving Kühner's circumscription.

Macroscopic descriptions are based on notes from fresh material. Color terms are those of Maerz & Paul (8), cited in the text as "M & P"; Ridgway (11), cited as capitalized color terms; or

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[1] Portion of a dissertation submitted to the Graduate School of the University of Michigan in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

the *ISCC-NBS Color Name Charts Illustrated with Centroid Colors* (3), cited as uncapitalized color terms. All specimens were studied microscopically in 2% KOH and in Melzer's reagent. Fresh specimens were also studied in water. Colors of microscopic structures are described as they appear in fresh specimens in water. Tangential and radial sections of the pileus with attached lamellae, as well as longitudinal sections of the stipe near the apex and base, were examined for structural composition and chemical reactions. Hymenial or cuticular elements are called cystidia in the present work if they have capitate or short- to long-appendiculate apices or if they project beyond the basidioles and have thin, hyaline walls. Cells with broad apical diverticula or nodulose cells (broom cells) are described with respect to their location and are not termed cystidia.

Drawings were made with the aid of a Leitz Ortholux microscope and drawing tube. Structures are shown as they appear in sections or in squash mounts in 2% KOH or in KOH-congo red.

Unless otherwise indicated by the appropriate symbol from the *Index Herbariorum* (7), all specimens are deposited in the University of Michigan Herbarium.

MARASMIUS section CHORDALES Fries, Epicr. Myc. 381. 1838.

Marasmius B *Chordales* Patouillard, Ess. Taxon. 145. 1900.
Marasmius §. *Mycena* I *Longipedes* Morgan, J. Mycol. 11: 237. 1905.
Marasmius section *Alliacei* ["*Alliateae*"] Kühner, Le Botaniste 25: 87. 1933.

Type species: *Marasmius chordalis* Fries, Epicr. Myc. 383. 1838.

Pileus medium-sized (3–30 mm broad), smooth or rugulose, striate or not, thin to moderately fleshy, firm, variable in color but not white. Odor and taste mild or of garlic or onions. Lamellae thin, well-developed, moderately numerous, distant to close, adnate to free or attached to a partial, adnate collar. Stipe thin to moderately thick, tough-pliant or cartilaginous to horny, pruinose to pubescent or glabrous, not insititious, often with a short pseudorrhiza. Rhizomorphs lacking, but sterile stipes sometimes present.

Spores clavate, obovate, pip-shaped, or lemon-shaped. Hymenial cystidia when present fusoid-ventricose, prominently projecting. Diverticulate cells sometimes present on the lamellar edge. Trama of pileus and lamellae nonamyloid. Pileus cuticle a hymeniform layer of smooth or apically nodulose, obovate or pyriform cells occasionally mixed with short cystidia. Clamp connections present throughout. Stipe cortex of thick-walled, smooth or incrusted hyphae. Stipe vesture of cystidioid or filamentous thick-walled hairs or rarely absent.

On deciduous leaves, needles of conifers, bark of living trees, or humus.

Key to Species of Section *Chordales*

1. Odor of crushed pilei faint to strong, of garlic or onions.
   2. Lamellae light-brown; spores 10–16 μm long; usually on oak leaves. 1. *Marasmius olidus*
   2. Lamellae light yellowish-pink to white; spores (5.6–) 6.7–9.5(–10) μm long; on pine needles, bark of living trees, grass, or humus. 2. *Marasmius scorodonius*
1. Odor of crushed pilei not of garlic or onions, often lacking altogether.
   3. Spores 4.2–7.3 μm broad, lemon-shaped or broadly fusoid-elliptic; pileus gray or brown tinged olive. 3. *Marasmius chordalis*
   3. Spores less than 4.2 μm broad, or if broader, then elliptic to obovate but not broadly elliptic or lemon-shaped; pileus variously colored but not tinged olive.
      4. Spores 4.3–7 μm long; capitate or subcapitate cystidia present in the pileus cuticle. 4. *Marasmius uliginosus*
      4. Spores 6–10 μm long; cystidia absent from the pileus cuticle.
         5. Hyaline diverticulate cells present on the lamellar edges; capitate or subcapitate cystidia absent from the lamellar faces.
            6. Stipe yellowish-white to light yellowish-brown overall; stipe vesture of abundant, hyaline, thick-walled hairs up to 77 × 11 μm. 5. *Marasmius insipidus*
            6. Stipe yellowish-white or some shade of yellow at the apex only, with the base various shades of brown or reddish-brown; stipe glabrous, or with a few short hairs near the base. 2. *Marasmius scorodonius*
         5. Hyaline diverticulate cells absent from the lamellar edges; capitate or subcapitate cystidia present on the lamellar faces and edges. 6. *Marasmius pyrrhocephalus*

FIG. 1. *Marasmius scorodonius*. *a*. Spores (*Gilliam 710*) ×2300. *b*. Spores (*Nannfeldt 16288*) ×2300. *c*. Spores (*Ammirati 1866*) ×2300. *d*. Diverticulate cells from lamellar edge (*Gilliam 710*) ×2300. *e*. Cells from cuticle (*Ammirati 1866*) ×1500. *f*. Tangential section of pileus cuticle (*Gilliam 710*) ×1500.

1. **Marasmius olidus** Gilliam, Mycologia 67(4), in press. 1975. Fig. 2.

PILEUS 3–18 mm broad; pulvinate or convex at first, then plano-convex and often umbilicate, finally plane or concave with a wavy margin; dry; dull; opaque; rugulose on the disc; at first even, then shallowly plicate or rugulose-striate to the disc; entire to crenate; pliant; reviving. CUTICLE minutely velutinous particularly on the disc; moderate brown in primordia, soon light yellowish-brown (M&P 11B4-5), often tinged pink, or moderate brown on the disc and light yellowish-brown elsewhere. TRAMA thin (up to 1.5 mm thick); firm; yellowish-white. ODOR pungent, of garlic. TASTE of garlic or onion.

LAMELLAE narrow (0.6–1.5 mm broad); thin; distant; moderately numerous (about 20 reach the stipe); unequal, with 2–3 irregular tiers of lamellulae; adnate, adnexed, or subdecurrent, sometimes seceding in age; membranous; entire or minutely fimbriate; straight; somewhat intervenose or not; rarely forked near the stipe; light yellowish-brown (M&P 11B4), concolorous with mature pilei.

STIPE 12–31 mm long, 0.2–2.1 mm thick; central; terete or flattened at the apex; tapered slightly to the base; straight or curved; dry; dull; opaque; hollow; cartilaginous; even; pruinose above, tomentose below, the vesture brownish-pink or occasionally white at the apex; yellowish-white or light yellowish-brown up to 2 mm from the apex downward, moderate brown, grayish-brown tinged pink, or blackish-brown below; not insititious. STERILE STIPES present along the leaf veins near the basidiocarps; tapered; glabrous; yellowish-brown. RHIZOMORPHS lacking. BASAL MYCELIUM forming a flat disc, often visible near the leaf veins as well; fine, resembling spun glass; white.

SPORES white in mass; 10.2–16.5(–19.6) × 2.8–3.8 μm; narrowly clavate and often curved. BASIDIA 26–36 × 4–8.5 μm; subclavate to clavate; 4- or rarely 2-spored. HYMENIAL DIVERTICULATE CELLS 9–34 × 4–11 μm; clavate, cylindric, or obovate; with occasional broad, rounded lobes or short diverticula; thin-walled; not projecting beyond the basidioles; present on the lamellar edges only. TRAMAL HYPHAE 2–8(–14) μm broad; interwoven; clamped; often inflated; with thin, hyaline to pale grayish-brown walls; nonamyloid. PILEUS CUTICLE an irregular hymeniform

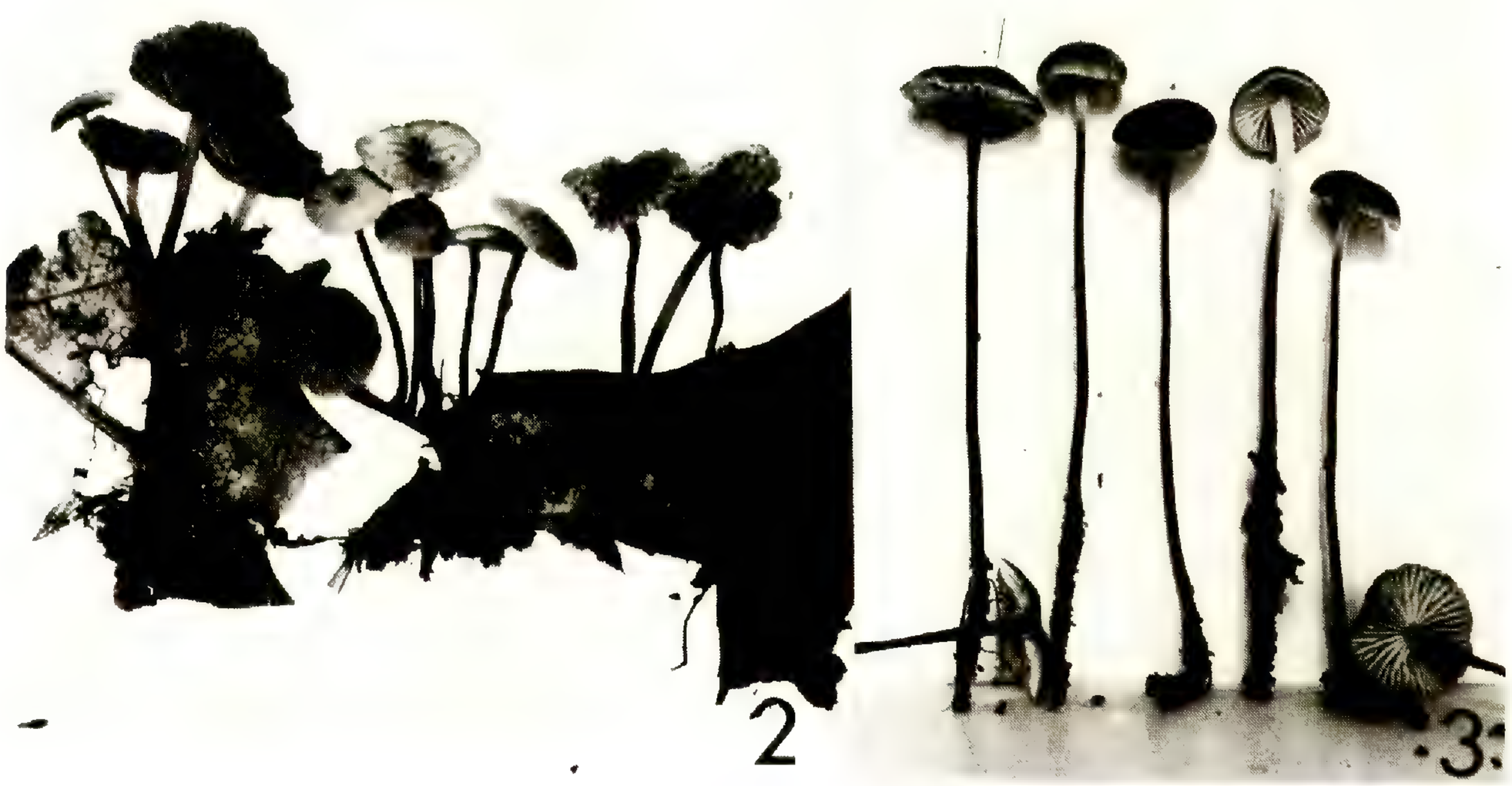


FIG. 2. *Marasmius olidus* (*Smith 33-1056*) ×1 (courtesy of A. H. Smith).

FIG. 3. *Marasmius chordalis* (*Smith 17399*) ×½ (courtesy of A. H. Smith).

layer of nonamyloid smooth cells 9–42 × 4–14(–24) μm which are globose to subcylindric or broadly cordate, often pedicellate, and occasionally 1-several-papillate, with hyaline, light yellowish-brown, or moderate reddish-brown, uniformly or unevenly thickened walls up to 1.5 μm thick. STIPE CORTEX of nonamyloid hyphae 2–8.5 μm broad with pale yellow to moderate reddish-brown walls up to 2 μm thick. STIPE TRAMA of nonamyloid, thin-walled hyphae 3–9 μm broad. STIPE VESTURE abundant overall; of nonamyloid, clavate to cylindric hairs 2.5–3.5 μm broad, with hyaline to moderate-brown walls up to 2.5 μm thick, which are light olive-green in 2% KOH.

Gregarious on veins of oak leaves in deciduous woods.

Collections examined: MICHIGAN: Livingston Co.: George Reserve, 4 Oct. 1936, *Smith 5034*. Oakland Co.: Proud Lake, 1 Nov. 1970, *Gilliam 997* (TYPE); Milford, 15 Sep. 1938, *Smith 10936* & 15 Oct. 1955, *Smith 51125*; Haven Hill, Highland Rec. Area, 11 Oct. 1959, *Smith 62192*. Washtenaw Co.: Ann Arbor, 1 Oct. 1933, *Smith 33-1056*; Silver Lake, Pinckney Rec. Area, 2 Oct. 1936, *Smith 5004*, & 23 Sep. 1938, *Smith 11057*.

For a discussion of *Marasmius olidus* and for drawings of microscopic structures see the original publication (1).

2. **Marasmius scorodonius** (Fries) Fries, Epicr. Myc. 379. 1838. Fig. 1.

[*Agaricus alliatus* Schaeffer, Fung. Bavaria 4: 43. *t. 99*. 1774.]
Agaricus scorodonius Fries, Syst. Myc. 1: 130. 1821.
?Agaricus calopus Persoon *ex* Fries, Syst. Myc. 1: 130. 1821.
?Marasmius calopus (Persoon *ex* Fries) Fries, Epicr. Myc. 379. 1838. *Nec Marasmius calopus* (Persoon) Quélet, Champ. Jura et Vosg. 222. 1872.
Marasmius alliatus (Schaeffer) Schröter *in* Cohn, Krypt. Fl. Schles. 3A: 559. 1889.
?Marasmius scorodonius (Fries) Fries var. *calopus* (Persoon *ex* Fries) Kauffman, Agar. Michigan 1: 72. 1918.

PILEUS (3.5–)6–30 mm broad; pulvinate, convex, or nearly plane with an incurved margin at first, becoming plano-convex, depressed-convex, obtusely campanulate, or plano-umbonate, sometimes umbilicate, papillate, or broadly depressed, finally plane with the margin wavy and uplifted; dry; shining when moist, soon dull; opaque; smooth at first, becoming minutely rugulose; rarely striate 2–7 mm from the edge inward; tough at first, soft-leathery when expanded; reviving. CUTICLE minutely pruinose at first, soon glabrous; moderate reddish-brown (Chestnut-Brown), moderate yellowish-brown (Clay Color), moderate-brown (M&P 14A8-9), light yellowish-brown (Pinkish-Cinnamon), or light-brown (Cinnamon, Mikado Brown) overall at first, remaining these colors on the disc and fading on the margin to pale orange-yellow (Light Pinkish Cinnamon, Light Ochraceous-Salmon, Pale Pinkish-Buff, Light Vinaceous-Cinnamon, Pale Pinkish-Cinnamon), or rarely pale-yellow (Cartridge Buff), in age often with these paler colors overall. TRAMA thin (0.5–2 mm thick); concolorous with the cuticle when moist, fading to yellowish white or white. ODOR of garlic or onion. TASTE of garlic, with a bitter-garlic aftertaste.

LAMELLAE narrow (1.5 mm broad in a pileus 12 mm broad, up to 3 mm in larger pilei); thin; close to subdistant or rarely distant; moderately numerous (16-30 reach the stipe); unequal, with numerous lamellulae in 2–5 tiers; adnate, adnexed, or nearly free, sometimes attached to a partial, adnate collar; pliant; entire, erose or minutely fimbriate; straight or broadest near the stipe; intervenose or not; usually forked; light yellowish-pink (Pinkish-Buff, Pale Cinnamon-Pink) at first, nearly white (M&P 9B1) or white in age.

STIPE 15–60 mm long, 0.2–3.5 mm broad; central; terete, compressed at the apex, or conduplicate, particularly in age; usually tapered to the base, occasionally equal; straight or curved; dry; shining; opaque; stuffed to hollow; cartilaginous, becoming horny in age; even; glabrous or rarely with minute, scattered, short, brown

fibrils, sometimes minutely yellowish-tomentose at the base; yellowish-white, pale yellow (Cartridge Buff), pale orange-yellow (M&P 9C-E3, 10D4), or light yellowish-pink (Pinkish-Buff, Pale Cinnamon-Pink) and sometimes tinged dark orange-yellow (Mars Yellow) at the apex at first, becoming moderate-orange (Orange-Cinnamon), moderate reddish-brown (Bay), brownish-orange (Tawny, M&P 14A11), light-brown (M&P 12B8, Mikado Brown, Cinnamon), grayish reddish-brown, or deep yellowish-brown (M&P 13I9) below, in age dark-brown, blackish-brown, or nearly black at the base; non-insititious, but with only a few minute fibrils at the base and thus often appearing insititious in dried specimens; often inserted obliquely. STERILE STIPES absent. RHIZOMORPHS absent. BASAL MYCELIUM inconspicuous.

SPORES white in mass; (5.6–)6.7 9.5(–10) × 2.8–4.2(–5) μm; elliptic, pip-shaped, or obovate. BASIDIA 22–45 × 4–8.5 μm; subclavate to clavate; 4- or rarely 2-spored. HYMENIAL DIVERTICULATE CELLS 5.5–40 × 4–11 μm; clavate, cylindric, ovate, obovate, lobed, or subdendroid; sometimes with short, dichotomous or sympodial branches; with hyaline walls up to 1.5 μm thick; with 2–20 apical or lateral, blunt or rounded, hyaline, knoblike or rodlike diverticula 2–10 × 1.5–3 μm; nonamyloid; present only on the lamellar edges. TRAMAL HYPHAE interwoven and inflated up to 14 μm broad in the pileus; parallel to interwoven, uninflated, and 2.5–7 μm broad in the lamellae; with hyaline walls up to 1 μm thick; clamped; nonamyloid. PILEUS SUBCUTIS 7–56 μm thick; of ascending-interwoven, nonamyloid connective hyphae 2.6–10 μm broad, with pale-yellow, dark orange-yellow, or light-brown walls up to 1.5 μm thick and often with the wall ruptured at intervals (appearing incrusted); with occasional thick-walled, lobed or globose hyphal ends. PILEUS EPICUTIS a hymeniform layer 5 -45 μm thick; of clavate, globose, pyriform, elliptic, ovate, lobed, or turbinate, often pedicellate cells 5–42 × 4–14 (–35) μm which are smooth or with 2–20 blunt or knoblike projections 1.5–7 × 1.5–4 μm and which have hyaline to dark orange-yellow walls up to 6 μm thick, often with irregular pigment deposits on the walls or with the wall ruptured at intervals. STIPE CORTEX only in pigmented portions, the surface hyphae elsewhere hyaline and undifferentiated; of connective hyphae 4–7 μm broad with pale-yellow to deep-brown pigment deposits which give the surface a mottled appearance. STIPE TRAMA of thin-walled non-amyloid connective hyphae 3–9 μm broad with hyaline walls up to 1 μm thick. STIPE VESTURE usually lacking except for a few short, hyaline hairs near the base.

Scattered or gregarious and sometimes in troops on conifer needles, on the bark of living trees, or rarely on blades of grass in deciduous, deciduous-coniferous, or coniferous woods or occasionally in open, grassy areas.

Collections examined: FRANCE: RHÔNE: La Tour de Salvaguy, 16 Jul. 1938, *Josserand.* GERMANY: Near Finsterwalde in the Niederlauritz, Aug. 1886, *Krieger, Fungi Saxonici 367* (NY, MICH); Brandenburg, Sophienstädt near Biesenthal, Nieder-Barnim, 2 Jul. 1910, *Sydow 852.* NETHERLANDS: GELDERLAND: Wageningen, 3 Aug. 1959, *Bakker.* RUSSIA: Udelnaja, near Leningrad, 15-27 Aug. 1898, *Elenkin,* in Jaczewski's *Fungi Rossiae Exsiccati 181* (NY). SWEDEN: Stockholm, 27 Oct. 1895, *Romell* (NY); Uppsala, 1853, *Fries* (FH); Uppsala, Staksskogen, 15 Aug. 1945, *Lundell*; Gryt Parish, Östergötland, Strömmen, 25 Jul. 1960, *Nannfeldt 16288.*

CANADA: BRITISH COLUMBIA: Nanaimo Co.: North Arm Forest, Lake Cowichan, Vancouver Island, 16 Sep. 1943, *Buckland.* NOVA SCOTIA: Colchester Co.: Upper Brookside, 22 Jul. 1931, *Smith 689.* ONTARIO: Russell Co.: Ramsayville, 19 Jul. 1951, *Groves 26706.* Timiskaming Co.: Gull Lake Portage, Lake Timagami, 9 Sep. 1936, *Smith 4719.* QUEBEC: Portneuf Co.: St. Gabriel-Ouest, 29 Jul. 1967, *Shaffer 5584.*

UNITED STATES: ILLINOIS: Cook Co.: Paddock Woods Forest Preserve, 22 Jun. 1956, *Shaffer 787.* MAINE: Aroostook Co.: near Madawaska Lake, 10 Jul. 1956, *Bigelow 3156.* Hancock Co.: Castine, Aug. 1897, *Apresham* (FH). Penobscot Co.: Off Rt. 11, near Norcross, 22 Jul. 1962, *Bigelow 10427* (MASS). Piscataquis Co.: Chesuncourt Lake, 17 Jul. 1962, *Bigelow 10311.* MARYLAND: Frederick Co.: Loop Mt., State Sanatorium, Aug. 1920, *Kelly 530.* MASSACHUSETTS: Franklin Co.: Shutesbury (Banfields), 9 Jul. 1958, *Bigelow 6773* (MASS). Middlesex Co.: Cambridge, 12 Aug. 1943, *Singer* (FH); Cambridge, 20 Jun. 1907, *Bartlett 750* (FH).

MICHIGAN: Allegan Co.: New Richmond, 25 Sep. 1911, *Kauffman.* Barry Co.: The Pines, Yankee Springs Recreation Area, 24 Jul. 1970, *Gilliam 810*; Otis Lake, Yankee Springs Recreation Area, 24 Jul. 1970, *Gilliam 812* & 16 Aug. 1966, *Mazzer 4261.* Cheboygan Co.: Pine Point, Univ. of Michigan Biol. Station, 13 Jul. 1957, *Smith 57314.* Gratiot Co.: Ithaca, 12 Sep. 1947, *Potter 3841*; Crystal, 20 Jul. 1950, *Potter 9795.* Jackson Co.: Updike Rd., Waterloo Recreation Area, 21 Sep. 1971, *Gilliam 1235.* Livingston Co.: George Reserve, near Pinckney, 13 Jul. 1964, *Homola 903.* Marquette Co.: Conway Lake, Huron Mt. Club, 18 Jul. 1968, *Ammirati 1866*; Howe Lake, Huron Mt. Club, 14 Jul. 1970, *Ammirati 4411*; Ives Lake, Huron Mt. Club, 21 Jul. 1971, *Gilliam 1164.* Midland Co.: Midland City Forest, 13 Oct. 1971, *Gilliam 1461 & 1473.* Oakland Co.: Kent Rd., 12 Aug. 1937, *Smith 6987.* Ontonagon Co.: Government Peak Trail, Porcupine Mts. State Park, 31 Aug. 1962, *Peters 1191.* Oscoda Co.: Perry Creek, 20 Jul. 1970, *Gilliam 737.* Washtenaw Co.: Winnewana Lake, 11 Jul. 1970, *Gilliam 639, 640, & 652*; Stinchfield Woods, 9 Oct. 1971, *Gilliam 1453*; Ann Arbor, 17 Jun. 1911, *Kauffman 806*; Univ. Michigan Bot. Garden, Ann Arbor, 11 Jul. 1970, *Gilliam 710*; New Richmond, 25 Sep. 1911, *Kauffman.* MINNESOTA: Rice Co.: Nerstrand Woods State Park, 15 Jul. 1968, *Weaver 1588*; Weaver yard, 425 SW Third St., Fairibault, 29 Jul. 1970, *Weaver 2018.* NEW HAMPSHIRE: Carroll Co.: Fendler's Woods, Chocorua, Aug. 1906, *Farlow* (FH). Hillsboro Co.: Fox Forest, Hillsboro, 14 Aug. 1959, *Miller 250.* NEW JERSEY: Gloucester Co.: Newfield, 10 Jul. 1896, *Ellis* (FH). NEW YORK: Essex Co.: Lewis, 23 Aug. 1920, *Povah.* Warren Co.: State College of Forestry Camp near Warrensburg, 26 Sep. 1971, *Gilliam 1292*; Hudson River, near Warrensburg, 26 Sep. 1971, *Gilliam 1301.* NORTH CAROLINA: Swain Co.: Deep Creek, 1 Sep. 1971, *Harrison 10986.* OHIO: Hocking Co.: Cedar Falls, 17 Jul. 1960, *Cooke 32109.* PENNSYLVANIA: Monroe Co.: Pocono Lake Preserve, Sep. 1936, *Stifler* (BPI). VERMONT: Lamoille Co.: Mt. Elmore State Forest, 30 Jul. 1964, *Bigelow 13184* (MASS). Windham Co.: Newfane Hill, 24 Jun. 1961, *Shaffer 2841*; Williamsville-Newfane Rd., 15 Jul. 1961, *Shaffer 2907 & 2908.* WISCONSIN: Dunn Co.: Red Cedar River near Upper Tainter Lake, 30 Jun. 1971, *Mazzer 6534.* Walworth Co.: Wychwood, Lake Geneva, 20 Jul. 1956, *Shaffer 902.*

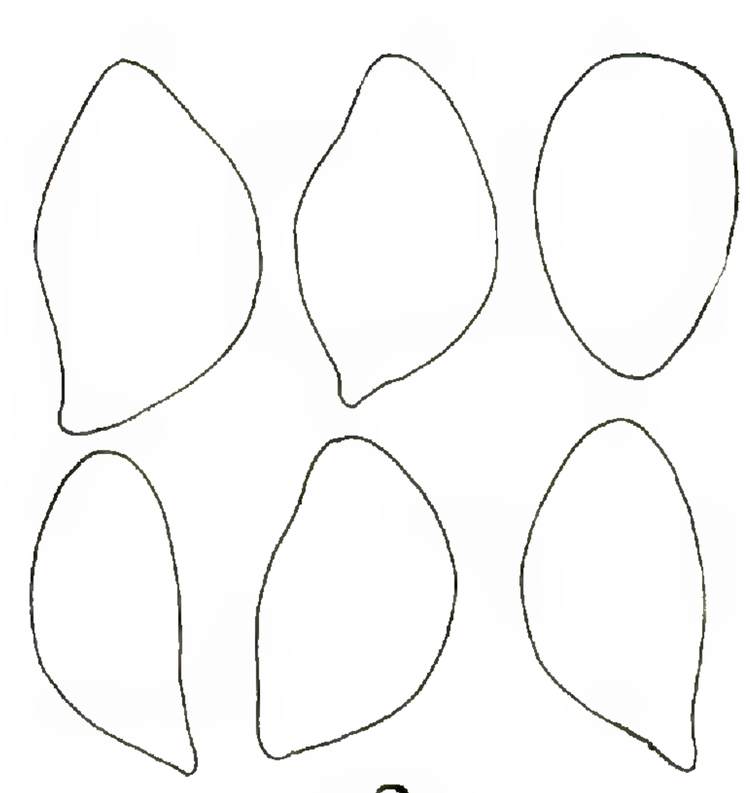
There are, as far as I know, no type specimens of either *Marasmius scorodonius* or *M. calopus.* I have, however, seen a specimen of *M. scorodonius* from Uppsala determined by Fries, and there seems little doubt that it belongs to the same species as the North American material. The identity of *M. calopus* poses a problem. Both Kauffman (2) and Peck [Annual Rep. New York State Mus. 31: 36. 1878 (1879)] recognized *M. calopus* as either a variety or a species. Both cited the differences from *M. scorodonius* to be a lack of odor, a different lamellar insertion, and a whitish pileus. Peck's specimens labelled *M. calopus* are actually *M. delectans* Morgan. A collection determined by Kauffman as *M. scorodonius* var. *calopus* (Ann Arbor, Mich., 17 Jun. 1911, *Kauffman 806*) shows a marked garlic odor when re-moistened and is indistinguishable from another collection which he called *M. scorodonius* (New Richmond, Mich., 25 Sep. 1911, *Kauffman*). The normal range of variation in strength of odor and lamellar attachment is broad in *M. scorodonius,* so that the characters cited do not seem sufficient to separate *M. calopus* as a distinct taxon. Singer (15) considered it a *nomen dubium,* since it was associated by Fries in the literature with two entirely different specific concepts.

Marasmius scorodonius shows perhaps the broadest habitat range of any of the temperate species of *Marasmius.* Growth is most luxuriant on conifer needles and least so on blades of grass. Tehon (18) reported damage to wheat by *M. scorodonius.* This is one of the few species of *Marasmius* which grows on the bark of living trees.

3. **Marasmius chordalis** Fries, Epicr. Myc. 383. 1838. Figs. 3 & 4.

PILEUS 10–20 mm broad; broadly convex with the disc depressed; moist; dull; entire; almost membranous but soft and pliant. CUTICLE at first white-hoary, soon glabrous; light yellowish-brown (Buffy Brown) on the disc, dark grayish-yellow (Dark Olive-Buff) on the margin, or brown with an olive cast overall, fading to olive-gray in age. TRAMA thin; white. ODOR and TASTE lacking.

LAMELLAE moderately broad; subdistant; equal at first, soon unequal, with 2 irregular tiers of lamellulae; adnate or with a slight tooth; entire; concolorous with the pileus.



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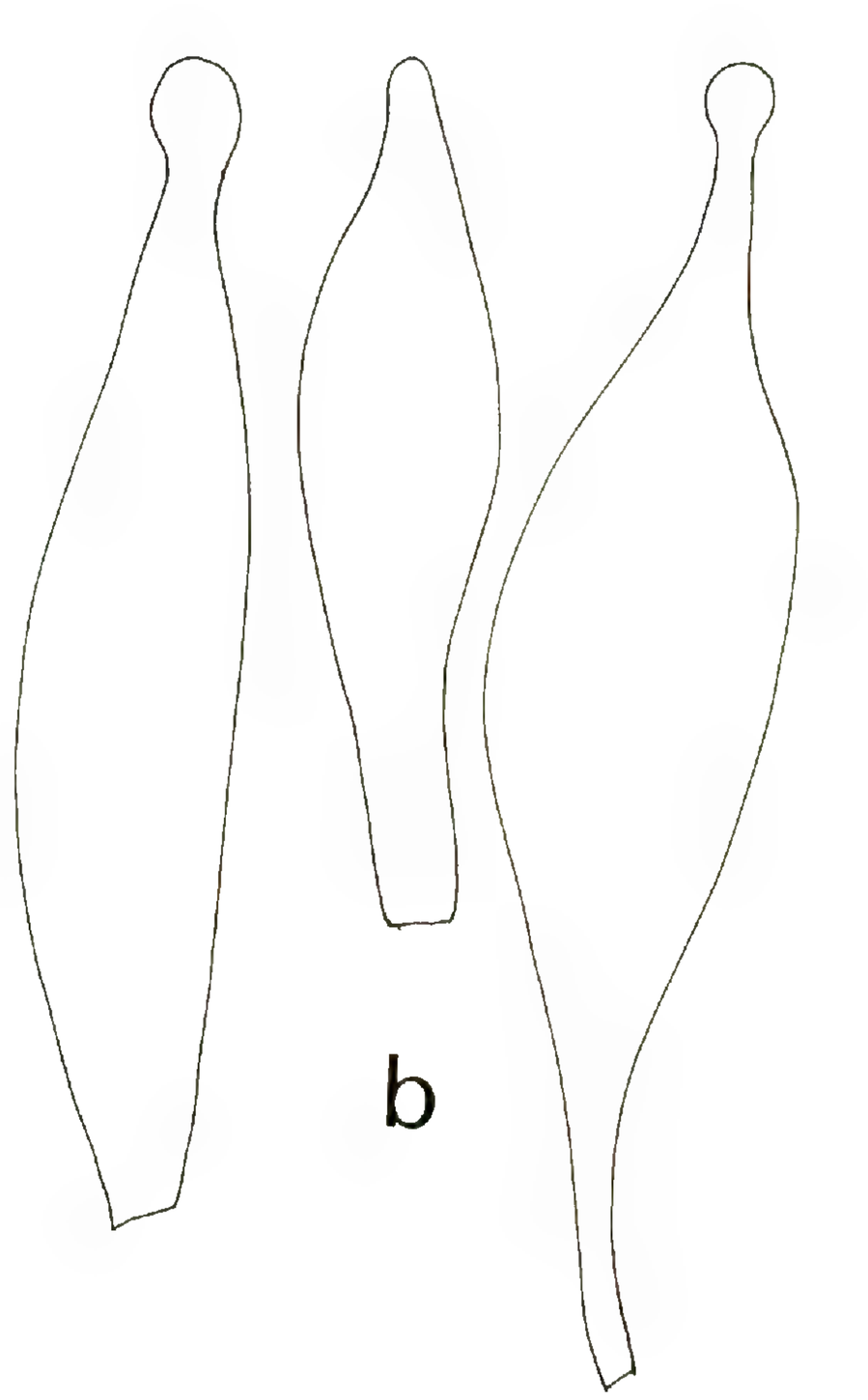

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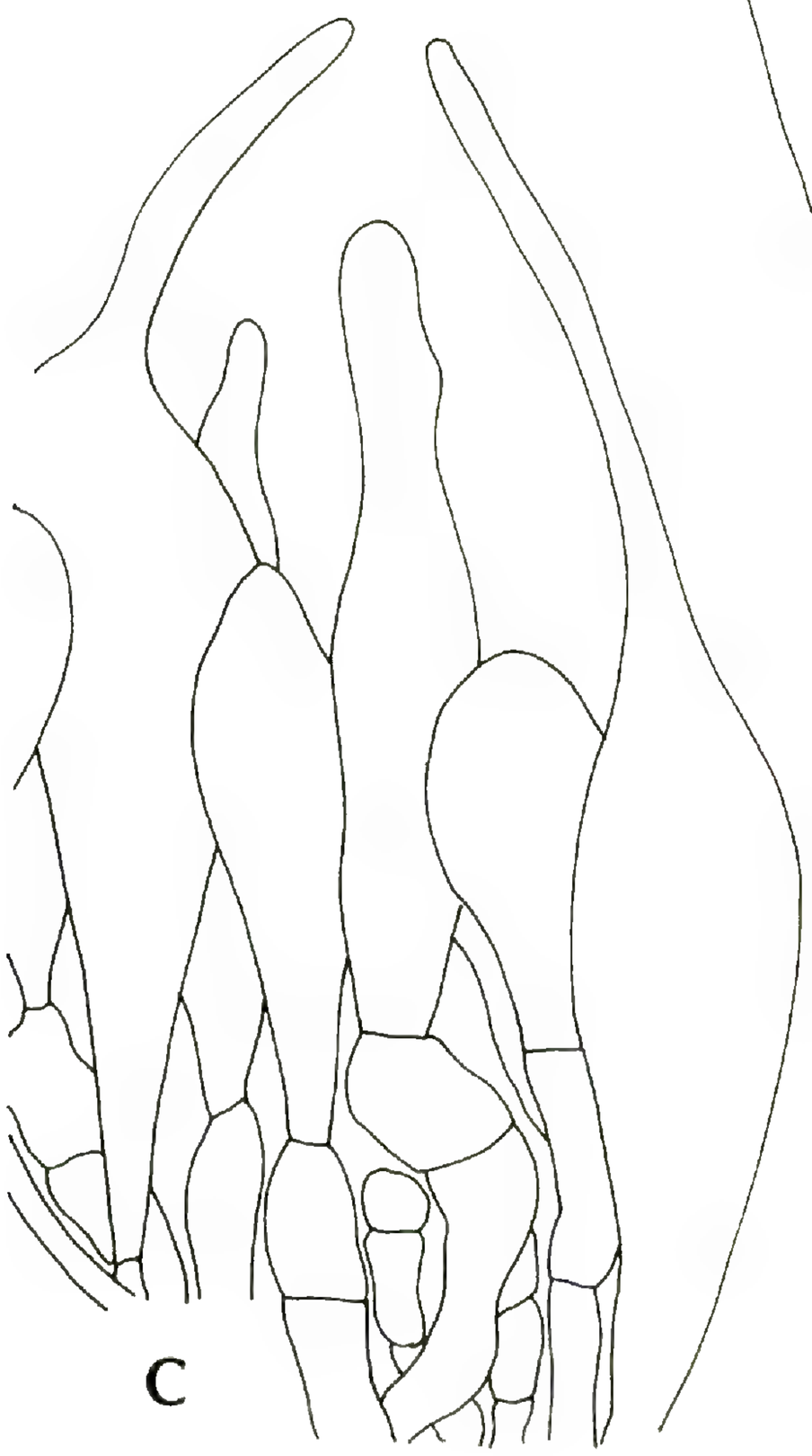

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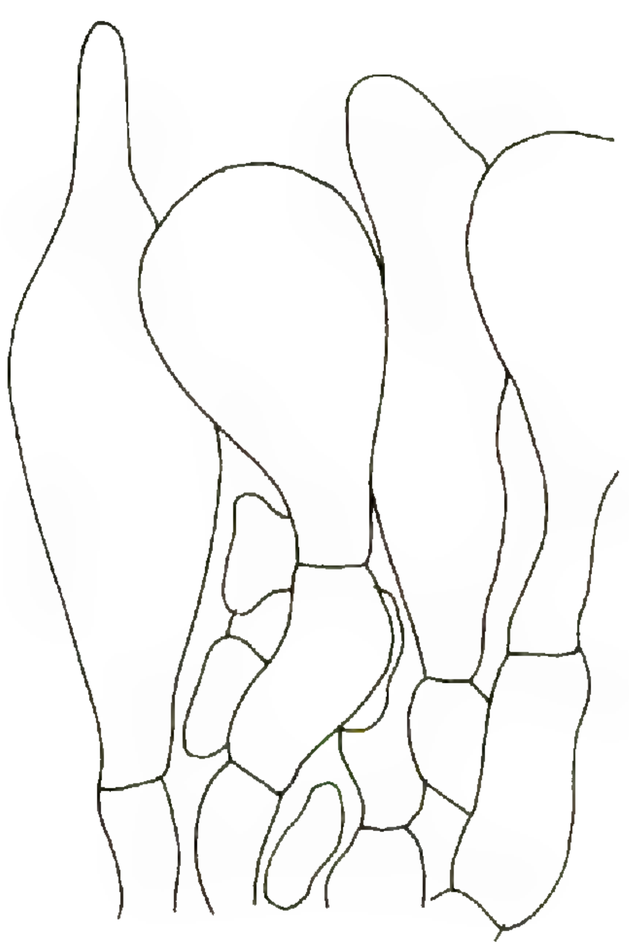

d

FIG. 4. *Marasmius chordalis*. *a*. Spores (*Smith 17399*) ×2300. *b*. Hymenial cystidia (*Smith 17399*) ×1500. *c*. Radial section of pileus cuticle showing area near the center of the pileus (*Smith 17399*) ×1500. *d*. Portion of the same radial section showing area near the pileus edge (*Smith 17399*) ×1500.

STIPE 60–100 mm long, 2–2.5 mm thick (unusually long in relation to the pileus size); central; terete; equal; straight; flexible but tough; white-pruinose and beaded with drops at the apex; densely scurfy overall; dark-brown or dark grayish-yellowish-brown (Bister) below; radicating. STERILE STIPES absent. RHIZOMORPHS absent. BASAL MYCELIUM not observed.

SPORES white in mass; 6.6–11.2 × 4.2–7.3 μm; lemon-shaped, broadly fusiform or broadly elliptic. BASIDIA 24–48 × 5.5–8.5 μm; clavate, often with a long, narrow base; 4- or rarely 2-spored. HYMENIAL CYSTIDIA (23–)37–84 × 4–14 μm; lecythiform, fusoid-ventricose, lanceolate, or subcylindric; usually capitate, or if not, with the apex rounded; with thin, hyaline walls; projecting up to 35 μm beyond the basidioles; fragile, soon collapsing; nonamyloid; rare to abundant on the lamellar edges and faces. TRAMAL HYPHAE interwoven and occasionally inflated up to 11 μm broad in the pileus; parallel to interwoven, uninflated and 1.5–7 μm broad in the lamellae; with thin, hyaline to light grayish-yellow walls; clamped; nonamyloid. PILEUS CUTICLE a hymeniform layer of three intergrading cell types which may not all be present: (1) smooth cells 11–57 × 5–17 μm which are clavate, obovate, subglobose, sphaeropedunculate, fusiform, or broadly cylindric and which have thin, hyaline to light grayish-yellow walls; (2) hairs 10–70 × 2–4 μm which are cylindric, often with wavy outlines and may be rarely branched or 1-septate, with hyaline walls up to 1.5 μm thick at the apex; and (3) smooth, appendiculate cells combining the characteristics of the first two types, with clavate, fusiform, or obovate bases and filamentous apices. STIPE CORTEX when present of nonamyloid connective hyphae 2–7 μm broad, with grayish-yellow to moderate yellowish-brown walls up to 1.5 μm thick. STIPE TRAMA of nonamyloid connective hyphae 2–7 μm broad, with hyaline walls up to 1 μm thick. STIPE VESTURE of abundant nonamyloid cystidia 3–10 μm broad which are filamentous, clavate, or fusoid-clavate and capitate or rounded apically, with hyaline to light grayish-yellow walls up to 1.5 μm thick and which sometimes contain oil droplets and are occasionally 1-septate.

Solitary to gregarious under bracken, spruce, fir, or pine in open areas in deciduous or coniferous woods.

Collections examined: ITALY: Sopramonte, Sep. 1901, *Bresadola* (NY). SWEDEN: Stockholm, 24 Sep. 1899, *Romell* (NY); Uppsala, *Sunnerstarhog 1250* (FH).

CANADA: QUEBEC: Kamouraska Co.: Ste.-Anne-de-la-Pocatière, 6 Sep. 1959, *Smith 61996.*

UNITED STATES: CALIFORNIA: Del Norte Co.: Crescent City, 4 Nov. 1937, *Smith 8423.* MICHIGAN: Cheboygan Co.: Maple River, 23 Sep. 1949, *Smith 34162*; Reese's Bog, 4 Sep. 1957, *Smith 57903.* Emmet Co.: Pellston, 27 Sep. 1953, *Smith 43445*; Pellston, 17 Jul. 1953, *Smith 42767.* Gratiot Co.: Potter's Woods, *Sumner,* 18 Sep. 1949, *Potter 8942*; Buzzard's Woods, Ithaca, 1 Oct. 1947, *Potter 4069.* Livingston Co.: George Reserve, near Pinckney, 4 Oct. 1936, *Smith 5020.* Ogemaw Co.: Rifle River, 4 Sep. 1963, *Smith 67402.* NEW YORK: Tompkins Co.: Ithaca, 31 Oct. 1902, *Thomas.* OREGON: Clackamas Co.: Rhododendron, 1 Oct. 1944, *Smith 19332,* & 14 Oct. 1944, *Smith 19709*; Welcher, 11 Oct. 1946, *Smith 24426.* Josephine Co.: Grants Pass, 11 Nov. 1956, *Smith 55446,* & 14 Nov. 1956, *Smith 55667.* Lane Co.: Blue River, 17 Oct. 1935, *Smith 7912.* Mt. Hood National Forest: Bear Springs, 11 Oct. 1947, *Smith 27625.* WASHINGTON: Clallam Co.: Crescent Beach, 22 Sep. 1935, *Smith 2553;* Joyce, 29 Sep. 1941, *Smith 17399.* Pierce Co.: Eatonville Woods, 18 Oct. 1954, *Smith 49204.*

The description of macroscopic characters is adapted from notes with *Smith 2553.*

Although I have examined material of *Marasmius chordalis* from Europe, I have not seen type material. Both the European and North American collections cited above agree with Singer's (13) drawings and description of *M. chordalis.*

Spore size varies considerably and thus seems to lack taxonomic significance. *Smith 55446*, for example, has spores whose measurements fall in the lower part of the range (7–8.7 μm long), whereas *Smith 55667,* a larger collection made three days

later from the same location, has longer spores (8.4–11.2 μm long). Width of the spores is a more constant feature, with all collections examined having spores more than 4 μm broad, an unusual situation in *Marasmius*. The peculiar spore shape also seems to be unique, at least in the North American representatives of the genus.

The pileus cuticle is usually composed of subglobose to clavate cells at first. Some or all of these proliferate at their apices, with the frequency of proliferation accounting for the differences in vesture of various collections. In older pilei the broader cells collapse, but the filamentous ones remain intact. This may give the suggestion of a trichoderm, or, if the filaments become appressed to the surface, even a cuticle of filamentous interwoven hyphae.

4. **Marasmius uliginosus** Gilliam, Mycologia 67 (4), in press. 1975. Fig. 5.

PILEUS 11–25 mm broad; convex to conic or nearly plane; depressed on the disc or not; dry; dull; opaque; smooth; even or faintly striate on the margin at first; entire; pliant. CUTICLE minutely pruinose or glaucous; at first moderate yellowish-brown overall, then moderate yellowish-brown on the disc and light yellowish-brown (Wood Brown) or paler (Tilleul-Buff) on the margin, finally light yellowish-brown overall, remaining these colors on drying or becoming brownish-gray, light brownish-gray, or light grayish-brown. TRAMA thin; white or nearly so. ODOR and TASTE not observed.

LAMELLAE narrow; thin; close; numerous (24–36 reach the stipe); unequal, with numerous lamellulae in 5 tiers; adnate to adnexed; at first straight, then subventricose; minutely pruinose; not intervenose; not forked; white.

STIPE 23–70 mm long, 1–2 mm thick; central; terete or flattened; expanded at the apex, otherwise equal above the radicating base; straight or curved; dry; dull or

FIG. 5. *Marasmius uliginosus* (*Harrison 12093* & *12094*) ×1½. The largest basidiocarp is from *12094* (courtesy of Kenneth A. Harrison).

shining; opaque; hollow; pliant; even; pubescent above, densely tomentose below, the vesture white above and light yellowish-brown or dark orange-yellow below; not insititious. STERILE STIPES absent. RHIZOMORPHS absent, but the stipe radicating up to 25 mm, with the rooting portion somewhat thickened. BASAL MYCELIUM copious on the radicating portion of the stipe, often with debris adhering; light yellowish-brown.

SPORES 4.3–7.0 × 2.1–3.0 μm; narrowly elliptic or pip-shaped. BASIDIA 15–20 × 3–4 μm; subclavate or subcylindric; 4- or rarely 2-spored. HYMENIAL CYSTIDIA 39–53 × 5.5–8.5 μm; cylindric, subfusiform, or fusoid-ventricose; subcapitate or capitate; with hyaline walls up to 1 μm thick; projecting up to 20 μm beyond the basidioles; abundant on the lamellar edges and faces. TRAMAL HYPHAE interwoven and inflated up to 22 μm in the pileus; parallel, uninflated and 4–10 μm broad in the lamellae; with hyaline walls up to 1.5 μm thick; clamped; nonamyloid. PILEUS CUTICLE a hymeniform layer of two types of cells: (1) obovate to subcylindric smooth cells 11–20 × 4–13 μm, with hyaline walls up to 1.5 μm thick; and (2) cylindric or narrowly fusoid-ventricose cystidia 38–90 × 4–11 μm, with capitate or rounded apices and hyaline walls up to 1.5 μm thick. STIPE CORTEX of nonamyloid connective hyphae 4–14 μm broad with hyaline to dark orange-yellow walls up to 2 μm thick. STIPE TRAMA of nonamyloid hyphae 3–17 μm broad, with hyaline walls up to 2 μm thick. STIPE VESTURE of abundant cylindric, tapered, or fusoid-ventricose cystidia 6–105 × 4–10 μm, with capitate or rounded apices and walls up to 1.5 μm thick.

Scattered in ravine on wet, mossy ground.

Collections examined: CANADA: NOVA SCOTIA: Kings Co.: Research Station, Kentville, 20 Sep. 1972, *Harrison 12093* (TYPE) & *12094*.

For a discussion of *Marasmius uliginosus* and drawings of microscopic structures see the original publication of this species (1).

5. **Marasmius insipidus** Gilliam, Mycologia 67 (4), in press. 1975.

PILEUS 3–24 mm broad; convex at first and remaining so for a long time, in age plano-convex; dry; dull; opaque; smooth at first, soon closely rugulose-striate up to ½ the pileus radius; entire; pliant. CUTICLE minutely velutinous; at first moderate-brown, fading to light-brown or brownish-pink. TRAMA thin; yellowish-white. ODOR lacking in crushed pilei. TASTE mild, with an acrid aftertaste.

LAMELLAE narrow (up to 1.5 mm broad); thin; close; numerous; unequal, with numerous lamellulae; adnate or adnate-seceding; pliant; entire; broadest near the stipe at first, becoming ventricose; intervenose in age; not forked; white.

STIPE 26–40 mm long, 1–2 mm thick; central or somewhat eccentric; terete; slightly tapered to the base or equal with a slight swelling at the base; dry; dull or shining; opaque; hollow; cartilaginous; even; minutely whitish-pruinose overall; yellowish-white to light yellowish-brown or tinged brownish-pink; not insititious. STERILE STIPES and RHIZOMORPHS lacking. BASAL MYCELIUM scarcely evident.

SPORES 7–9.1 × 2.8–4.2 μm; pip-shaped, curved-cylindric, or rarely obovate. BASIDIA 22–34 × 4–7 μm; clavate or subclavate; 4-spored. HYMENIAL DIVERTICULATE CELLS 11–25 × 5.5–8.5 μm; cylindric, clavate, or obovate and often lobed; smooth or with 1–10 hyaline diverticula up to 4 × 4 μm, with hyaline walls up to 1 μm thick, scarcely projecting; abundant; present only on the lamellar edges. TRAMAL HYPHAE interwoven; 2–8(–11) μm broad; clamped; with hyaline to light grayish-olive walls up to 1.5 μm thick; nonamyloid. PILEUS CUTICLE a hymeniform layer of cylindric, clavate, or irregular cells 18–38 × 5.5–20 μm, which are often lobed or once-branched, and smooth or with 1–8(–12) blunt diverticula up

to 10 × 5 μm, with hyaline to light-gray walls up to 1 μm thick; often subtended by cells with light grayish-olive spiral incrustations. STIPE CORTEX of nonamyloid connective hyphae 1.5–4 μm broad with hyaline to light grayish-olive walls 0.5–1.0 μm thick. STIPE TRAMA of nonamyloid connective hyphae 3–17 μm broad, with hyaline walls up to 3 μm thick. STIPE VESTURE of abundant cylindric or fusoid-clavate hairs up to 77 × 11 μm, with hyaline walls up to 3 μm thick.

Gregarious to cespitose on wood fragments and oak leaves in deciduous woods.

Collection examined: OHIO: Portage Co.: West Branch State Park, 8 Jul. 1972, *Gilliam 1500* (TYPE).

For a discussion of *Marasmius insipidus* and for drawings of microscopic structures see the original publication (1).

6. **Marasmius pyrrhocephalus** Berkeley, London J. Bot. 6: 316. 1847. Fig. 6.

Marasmius macrorrhizus Montagne, Syll. Crypt. 142. 1856.
Marasmius longipes Peck, Bull. Buffalo Soc. Nat. Sci. 1: 58. 1873. *Non Marasmius longipes* Montagne, Ann. Nat. Sci. Bot. IV, 1: 114. 1854.
Marasmius elongatipes Peck, Bull. Buffalo Soc. Nat. Sci. 4: 181. 1882, *nom. nov.* for *Marasmius longipes* Peck.
Marasmius hirtipes Clements, Bot. Surv. Nebraska 4: 21. 1896. *Nec Marasmius hirtipes* Spegazzini, Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 112. 1898.

PILEUS 4–25 mm broad; convex to pulvinate at first, then convex or plano-convex and often depressed, umbilicate, or minutely papillate centrally, finally plane with the margin uplifted; moist to subviscid, soon dry; shining or dull, opaque, becoming translucent-striate overall; smooth or minutely rugulose; even at first becoming finely sulcate-striate to the disc in age; entire to crenate; pliant; reviving. CUTICLE glabrous; at first pale orange-yellow (M&P 10E4), moderate orange-yellow (M&P 11H7, Ochraceous-Buff), moderate-orange (M&P 11J9), or light yellowish-brown overall, then light orange-yellow (M&P 9J6) to dark orange-yellow (M&P 12L9), sometimes moderate- to deep-brown on the disc and paler (dark orange-yellow, dark-yellow, strong yellowish-brown) on the margin, occasionally tinged red, finally dark orange-yellow (M&P 13L8), brownish-orange (M&P 13L9, 13L1-2) or strong yellowish-brown (M&P 10F7), often darker on the disc (strong-brown, moderate-brown, or strong yellowish-brown) and in dried material. TRAMA up to 1 mm thick in the disc; translucent and colorless when moist, otherwise white, yellowish-white, or (in age) light yellowish-brown. ODOR slight. TASTE mild, slightly sweet, or occasionally with a bitter aftertaste.

LAMELLAE narrow (1.5 mm broad in a pileus 13 mm broad, up to 3 mm in older basidiocarps); thin; close to subdistant; moderately numerous (16–20 reach the stipe); unequal, with 2–4 tiers of lamellulae; adnate to adnexed; pliant or tough; entire; straight at first, sometimes becoming ventricose; not intervenose; not forked; nearly white or yellowish-white at first, soon dull pale-yellow to light yellowish-brown and often brown-dotted in age or when bruised.

STIPE 35–101 mm long, 0.5–1.5(–2.5) mm thick; central; terete; equal, slightly swollen at the apex, or tapering uniformly to the apex, usually radicating up to 5 cm below the ground level, the radicating portion irregular, somewhat thicker (up to 4 mm thick), and roughened; straight to curved; dry; dull; opaque; hollow or solid; tough or sometimes horny in old basidiocarps; even; minutely pruinose to pubescent above, densely tomentose to strigose below, with tangled, white, pale-yellow, light-gray, or moderate reddish-brown to deep-brown (rarely dark-brown) hairs; white to pale-yellow on the upper 1–15 mm in young basidiocarps, progressively darkening from the base

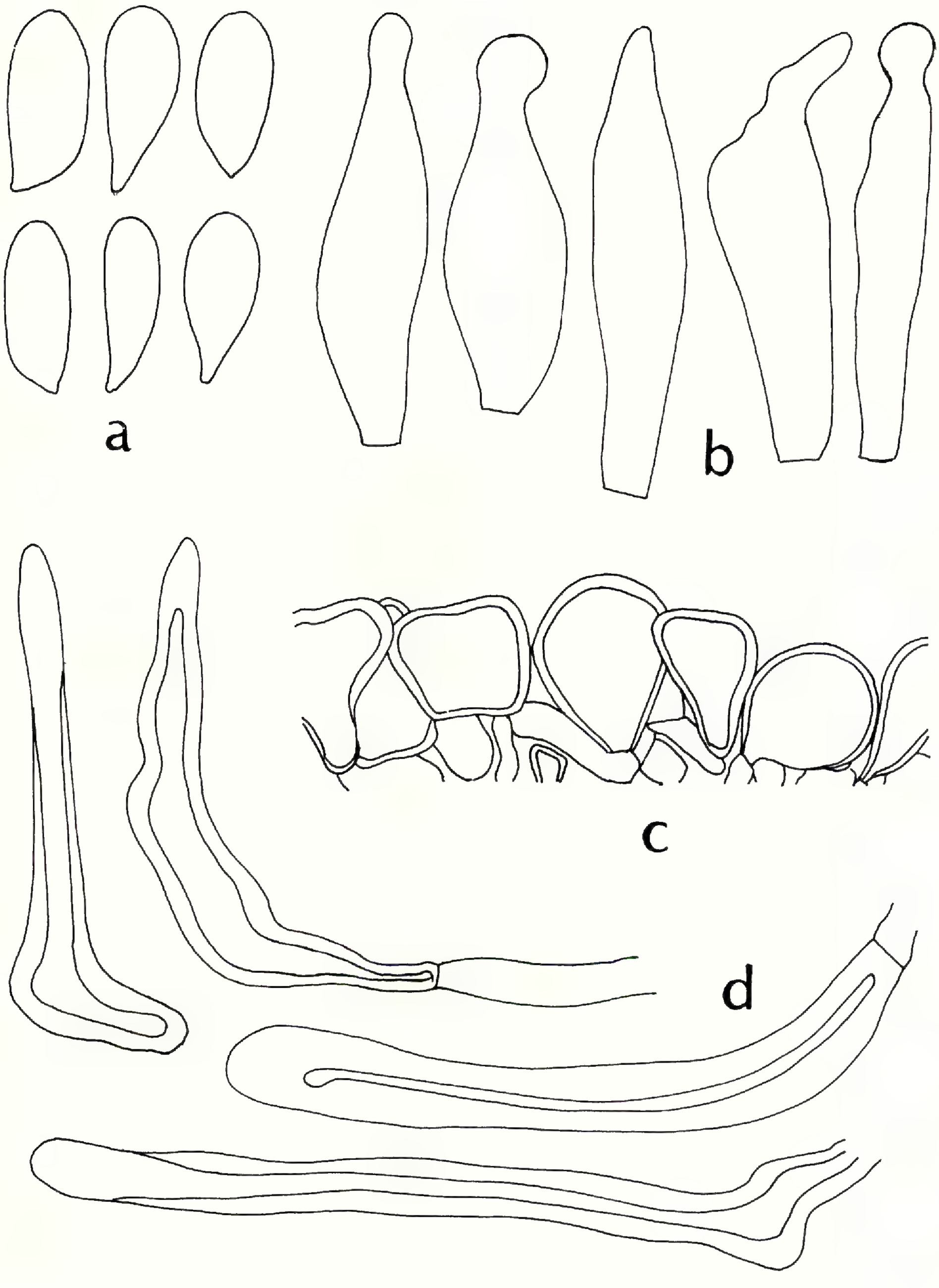

FIG. 6. *Marasmius pyrrhocephalus. a.* Spores (*Gilliam 496*) ×2300. *b.* Hymenial cystidia (*Gilliam 496*) ×1500. *c.* Cells from pileus cuticle (*Gilliam 496*) ×1500. *d.* Stipe hairs (*Gilliam 496*) ×1500.

upward through yellowish-brown, brownish-orange, or moderate-brown and finally blackish-brown at the base, with the darker colors almost overall in age. STERILE STIPES absent. RHIZOMORPHS absent. BASAL MYCELIUM sometimes present as a tuftlike cushion at the juncture of the stipe and substrate; white, pale-yellow, or light yellowish-brown.

SPORES white or pale yellowish-white in mass; 6.3–9.8 × 2.7–4.3(–5.1) μm; elliptic, obovate, fusoid-elliptic, or rarely subreniform. BASIDIA 22–35 × 4–8.5 μm; clavate or rarely subcylindric; 4-spored. HYMENIAL CYSTIDIA 29–73 × 2.5–9 μm; fusiform, fusoid-ventricose, or subcylindric; truncate or capitate, or with the apex tapered or rounded; empty or faintly granular; nonamyloid; with thin, hyaline walls; projecting up to 35 μm beyond the basidioles; rare to abundant on the lamellar edges and faces. TRAMAL HYPHAE tightly interwoven, uninflated, and 4–7 μm broad in the pileus; parallel to interwoven, uninflated, and 4–7 μm broad in the lamellae; with hyaline to pale yellow walls up to 0.5 μm thick; clamped; nonamyloid. PILEUS CUTICLE a hymeniform layer of smooth cells 8–24 × 4–24 μm which are clavate, truncate-clavate, globose, obovate, elliptic, pyriform, or turbinate and pedicellate or not, thin-walled at first, soon with moderate orange-yellow to light yellowish-brown walls up to 2 μm thick, rarely capitate, and nonamyloid or with granular dextrinoid contents when fresh. STIPE CORTEX when present of connective hyphae (2–)4–14 μm broad, with deep-brown walls up to 2 μm thick or with the wall occluding the lumen; nonamyloid or with granular dextrinoid contents in fresh basidiocarps. STIPE TRAMA of nonamyloid connective hyphae 2–11 μm broad, with hyaline walls up to 1 μm thick. STIPE VESTURE of hairs 10–130 × 2.5–9 μm which are cylindric to filiform, clavate, subglobose, pyriform, or elliptic and often spurred basally when near the stipe apex, with hyaline to pale-yellow walls up to 3 μm thick, subcapitate or with the apices rounded to acute, and scattered or clustered and often tangled.

Scattered, gregarious, or rarely subcespitose on decaying oak leaves and humus, rarely on wood, in deciduous or deciduous-coniferous woods.

Collections examined: CANADA: ONTARIO: York Co.: Don Valley, Toronto, 23 Jun. 1935, *Bell 7537* (FH).

UNITED STATES: CONNECTICUT: Fairfield Co.: Redding, 17 & 22 Jul. 1902, *Earle* (NY). MARYLAND: Frederick Co.: Point-of-Rocks, 1 Jun. 1924, *Cash* (BPI). MASSACHUSETTS: Middlesex Co.: Wakefield, 15 Aug., *Linder & Singer* (FH). MICHIGAN: Barry Co.: Deep Lake, 16 May 1970, *Mazzer 6029*. Gratiot Co.: Allen's Woods, Ithaca, 27 Jul. 1949, *Potter 7799*. Jackson Co.: Updike Rd., 21 Sep. 1971, *Gilliam 1236*; Big Portage Lake, 10 Oct. 1971, *Gilliam 1445*. Lenawee Co.: Vales Lake, 9 Jun. 1971, *Gilliam 1009*. Livingston Co.: George Reserve, 10 May 1967, *Hoseney 376*, 26 Sep. 1945, *Smith 20661*, & 4 Oct. 1971, *Gilliam 1316*. Oakland Co.: Haven Hill, Highland Recreation Area, 6 Oct. 1971, *Gilliam 1441*, 17 May 1968, *Ammirati 1465*, & 25 May 1970, *Gilliam 454 & 455*. St. Clair Co.: (no locality), 29 Aug. 1949, *Boynton*. Washtenaw Co.: Redwing Preserve, 12 May 1968, *Ammirati 1454*; Pinckney Recreation Area, 10 Aug. 1970, *Shaffer 2567*; Silver Lake, 8 May 1938, *Smith 9525*, & 14 Jun. 1970, *Gilliam 531*; Sharon Hollow, 16 Sep. 1970, *Gilliam 944*, & 26 Oct. 1948, *Smith 32015*; Stinchfield Woods, 29 Jul. 1970, *Gilliam 859*; Winnewana Lake, 11 Jul. 1970, *Gilliam 646 & 647*; Dieterle's Woods, 1 Jun. 1970, *Gilliam 496*. MINNESOTA: Rice Co.: Nerstrand State Park area, Sect. 16, Wheeling Twp., 30 May 1965, *Weaver 1134* & 23 Jun. 1968, *Weaver 1551*. MISSOURI: St. Louis Co.: St. Louis, *Glatfelter 856* (BPI). NEW JERSEY: (no location), Autumn 1909, *Ballow* (NY). NEW YORK: Onondaga Co.: Syracuse, Sep. 1889, *Underwood* (NY). Wayne Co.: Savannah, Aug., *Peck* (Lectotype of *Marasmius longipes* Peck, NYS); Bethlehem, Oct., *Peck* (syntype of *M. longipes* Peck, NYS). Westchester Co.: Chappaqua, Aug.-Sep. 1909, *Mrs. Rider & Mrs. Murrill* (NY). NORTH CAROLINA: Swain Co.: Almond, 21 Sep. 1971, *Harrison 11216 & 11217*. OHIO: Franklin Co.: Columbus, Jul., *Sullivant* (holotype of *Marasmius macrorrhizus* Montagne, PC). Hamilton Co.: Miami-Whitewater Forest Park, 13 Nov. 1960, *Cooke 32480*. Preble Co.: Hueston Woods State Park, 18 Oct. 1968, *Patrick 566*. Scioto Co.: Hobey Hollow, Shawnee State Forest, 4 Nov. 1961, *Cooke 33105*. Wayne Co.: Waynesville, 23 Aug. 1844, *Curtis* [holotype of *Marasmius pyrrhocephalus* Berkeley (K), 2 isotypes (K) (FH)]. VERMONT: Addison Co.: Middlebury, 14 Aug. 1897, *Burt* (FH). VIRGINIA: Montgomery Co.: Blacksburg, 27 Jul.-3 Aug. 1904, *Murrill* (NY).

I have seen the types of *Marasmius pyrrhocephalus* Berk. and of *M. longipes* Peck (=*M. elongatipes* Peck), and, as Singer (13) suggested, the two are definitely conspecific. Of the collections of *M. longipes* (the original name under which Peck described the species, rejected as a later homonym) cited in the original description, the Savannah collection is the more extensive and is here designated as lectotype of *M. longipes* and therefore also of *M. elongatipes*. I have not seen the type of *M. hirtipes* Clements, but the description fits this species well; I am following Pennington and others in synonymizing it here. *Marasmius morganianus* Sumstine (Mycologia 6: 35. 1914) probably also belongs here.

Marasmius pyrrhocephalus is one of the first agarics to appear in the spring and one of the last to cease fruiting in the fall. In June and October conspicuous fruitings of this species occur in the oak-hickory woods around Ann Arbor. In the early spring, however, basidiocarps are usually found growing singly.

In contrast to those of many *Marasmii,* pilei of basidiocarps of *M. pyrrhocephalus* darken markedly with age. This darkening is associated with the accumulation of a KOH-soluble, moderate orange-yellow pigment in the walls of the cuticular cells.

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THE TAXONOMY OF ACMANTHERA (MALPIGHIACEAE)

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The genus *Acmanthera* comprises five species of trees and shrubs in northern Amazonia. One species is fairly common and the other four are rare, each having been collected only once or twice. Niedenzu (1928) treated the two species known to him in his monograph of the family Malpighiaceae, and MacBryde (1970) recently re-described the same two species. Unfortunately MacBryde did not examine the material in the herbaria in Belém and Manaus, where I have recently found collections of three undescribed species. The five species fall into two natural groups, one of which will be described here as a new section. This brief treatment of the genus is intended as a means of publishing these new taxa in a context of keys and descriptions that will facilitate their recognition and comparison.

There are three genera of Malpighiaceae that have longitudinal wings on the outer locules of the anther. They are *Acmanthera, Lophanthera,* and *Pterandra.* The following key will summarize their principal differences:

1. Petioles and alternate bracteoles bearing large glands; carpels connate for their entire length along a central axis; styles inserted at apex of carpels. *Lophanthera* Adr. Juss.
1. Petioles and bracteoles eglandular; carpels nearly or quite free, sharing a flat or pyramidal torus; styles inserted on inner face of carpels, sub-apically to almost basally.
   2. Inflorescence a tight umbellate fascicle, sessile or subsessile, axillary to leaves or bracts or leaf scars on older stems; stipules up to 0.6 cm long, persistent; young internodes more or less terete. *Pterandra* Adr. Juss.
   2. Inflorescence an elongated pseudoraceme terminating an axillary shoot; stipules 1.5–11 cm long, deciduous; young internodes strongly flattened. *Acmanthera* Grisebach

Some of the characters used by Niedenzu to separate *Acmanthera* and *Pterandra* are not reliable. The anthers of *P. pyroidea* have an extension of the anther connective that is just as large as that in *Acmanthera* sect. *Microglossa.* Although the cocci of *Pterandra* are smaller than those of *Acmanthera* (so far as fruits are known) and retain the styles in a more nearly terminal position, they do not seem to be as different as Niedenzu suggested. I can find no evidence that the cocci of *Acmanthera* are dehiscent, and as for the "carpophore" which is supposed to be present in *Pterandra* and lacking in *Acmanthera,* the fact is that in *A. latifolia* the coccus has the same kind of inflated basal rim as cocci of *Pterandra* species. However, the two groups still stand as distinct and useful genera.

Acmanthera (Adr. Juss.) Grisebach *in* Martius, Fl. bras. 12(1): 29. 1858.

Pterandra sect. *Acmanthera* Adr. Juss. Ann. Sci. Nat. (2° Sér. Bot.) 13: 328. 1840.

Shrubs or trees to 15 m tall; younger internodes flattened at right angles to the subtending pair of leaves; older branches rounded. Leaves opposite, eglandular, entire or somewhat repand; primary lateral veins 9–12(–15) on each side of the midrib, very prominent below, slightly to moderately prominent above, connected by many strongly

parallel secondary veins; stipules 1.5–11 cm long, the 4 at each node pressed or fused together to form a sheath enclosing the shoot apex, deciduous, leaving large scars between the petiole bases. Inflorescence an unbranched pseudoraceme terminating an axillary shoot with 1 internode and 1 node; flowers 50–150 or more, borne in irregular clusters, circinnate in bud; pedicel sessile, subtended by a bract and 2 bracteoles. Receptacle concave, bearing straight basifixed hairs among stamens and around ovary. Calyx bearing 10 glands, these obovate, laterally compressed, longest at the posterior of the flower, attached on the outside of the receptacle below the 5 lobes of the calyx. Petals 5, inserted at apex of receptacle between and inside calyx lobes, imbricated in bud. Stamens 10; filaments free, flat, with a few basal hairs; anthers alike, glabrous, 4-locular, winged on the outer locules, the wing widening from base to apex, the connective glandular and bearing an apical appendage; anthers deciduous; pollen 3(–4)-colporate. Ovary 3-carpellate, the carpels free and ventrally adnate to a common flat or pyramidal torus, each carpel uniovulate; styles 3, inbent in bud, 1 inserted slightly ventrally on each carpel, very slender and tapering distally to a minute apical or slightly internal stigma. Fruit (where known) consisting of 3 (or fewer by abortion) dry, indehiscent, sub-spheroid cocci, each containing 1 seed free from the brittle, papery wall; apex of the coccus much exceeding the attachment of the persistent style.

TYPE: *Acmanthera latifolia* (Adr. Juss.) Grisebach.

Plants of this genus are usually collected by or near rivers or streams, not rarely in forests that are periodically flooded. The cocci are probably adapted to dispersal by water, being dry, light-weight, and indehiscent with air probably trapped between the wall and the seed. It is interesting to compare the individual mericarps of *Acmanthera* with whole compound fruits of *Burdachia* and *Glandonia,* which also have a tough, dry indehiscent wall and are probably also adapted for dispersal by water. *Coleostachys* may have fruits very much like those of *Acmanthera*; in this case there would be both functional analogy and structural homology.

Key to the Sections and Species of *Acmanthera*

1. Sepals triangular, acute to obtuse at the apex, uniformly sericeous abaxially, completely concealing the petals during enlargement of the bud; appendage of the connective 0.5–1.1 mm long, broad and thick, rounded and glandular at the apex; node subtending the inflorescence leafless, the leaves caducous, probably much reduced. sect. *Acmanthera*
   2. Bracts and bracteoles broadly orbicular and deeply concave, 2.0–4.0 mm long, 2.5 5.0 mm wide, imbricated around the young bud, often deciduous, with several parallel longitudinal nerves prominent adaxially; petals densely sericeous abaxially.
      3. Stipules 1.5–3.1(–4.3) cm long, the stipular sheath plicate, cruciform in cross-section; bracts and bracteoles uniformly chartaceous, densely and uniformly sericeous. 1. *A. latifolia* (Adr. Juss.) Grisebach
      3. Stipules 11–12 cm long,[1] the stipular sheath smooth, flattened, very narrowly elliptic in cross-section; bracts and bracteoles chartaceous and sericeous in the center, membranous and glabrous toward the margin. 2. *A. duckei* W. R. Anderson
   2. Bracts and bracteoles narrowly triangular and flat, up to 1.6 mm long and 0.9 mm wide, often smaller, not at all enclosing the bud, reflexed and persistent, with only the midrib developed and even that obscure; petals sparsely sericeous or glabrous abaxially. 3. *A. cowanii* W. R. Anderson
1. Sepals orbicular, broadly rounded at the apex, abaxially sericeous in the center and glabrous toward the apex or margin, already separated in young buds, leaving the

[1] Future collections of this species will show more variation and probably some diminution in this measurement.

petals exposed during enlargement of the bud; appendage of the connective up to 0.3 mm long, thin, tapered to an acute, non-glandular apex; node subtending the inflorescence usually bearing 2 persistent leaves. sect. *Microglossa* W. R. Anderson

4. Leaves, stipules, vegetative branchlets, and ovary sericeous or pilose-sericeous, at least originally; young stems with few, obscure lenticels; leaves up to 23 cm long and 9 cm wide. 4. *A. parviflora* W. R. Anderson

4. Leaves, stipules, vegetative branchlets, and ovary glabrous; even the young stems with large, coarse lenticels; larger leaves 23–35 cm long and 7.5–15 cm wide. 5. *A. longifolia* Niedenzu

Acmanthera sect. **Acmanthera**

Primary lateral veins of the lamina straight and strongly parallel; leaves of the node subtending the pseudoraceme caducous, probably much reduced; sepals completely concealing the petals during enlargement of the bud, triangular, acute to obtuse at the apex, abaxially densely and uniformly sericeous, adaxially glabrous; appendage of the connective 0.5–1.1 mm long, often sigmoid-reflexed, broad and thick, terminating in a hemispherical gland.

1. **Acmanthera latifolia** (Adr. Juss.) Grisebach *in* Martius, Fl. bras. 12(1): 29. 1858. Fig. 1.

Pterandra latifolia Adr. Juss. *in* Delessert, Icon. sel. pl. 3: 19, tab. 30. 1837 [1838].

Shrub or tree 2–15 m tall; younger branches brown-appressed-sericeous, older branches sericeous to glabrate, obscurely lenticellate. Leaves originally sericeous, soon glabrate above, usually persistently sericeous below, rarely glabrescent in age; lamina (7–)10–25(–30) cm long, (2.5–)4.0–11.5(–13.5) cm wide, broadly ovate or elliptic, obtuse to rounded at the base, acute or obtuse or obtusely acuminate and often apiculate at the apex, flat and entire at the margin; petiole 1.0–3.3 cm long; stipules 1.5–3.1(–4.3) cm long, appressed-sericeous on both sides, free interpetiolarly, connate intrapetiolarly for the proximal 3–5 mm and free distally, exduplicate-valvate, the sheath cruciform in cross-section. Inflorescence (2–)5–16 cm long, pilose-sericeous; internode subtending the inflorescence 1–4.5(–5.3) cm long, appressed-sericeous; bracts 2.3–3.4 mm long, 3.3–5.0 mm wide, orbicular, deeply concave, always wider than long, broadly attached, abaxially densely and uniformly sericeous, adaxially glabrous except at base, with several parallel nerves well-developed and adaxially prominent; bracteoles similar to bracts but slightly smaller, 2.0–4.0 mm long, 2.7–4.2 mm wide, only slightly wider than long, more narrowly attached; bracts and bracteoles imbricated around buds, persistent or, especially in fruit, deciduous; pedicels (5–)8–12 mm long, 0.8–1.0 mm in diameter, pilose-sericeous. Calyx glands 2.5–3.5 mm long, free at the apex; calyx lobes 3.0–3.7 mm long, 2.5–3.0 mm wide, revolute after anthesis. Petals white (or yellow?), abaxially sericeous on midrib and claw; 4 lateral petals soon reflexed, the claw 1.0–2.0 mm long, the limb 3.5–5.0 mm long, 2.5–3.5 mm wide, spatulate or elliptic, denticulate, revolute; posterior petal erect (belatedly reflexed), the claw thick, 1.5–2.5 mm long, the limb 3.5–4.5 mm long, 3.0–4.2 mm wide, orbicular or obovate, glandular-denticulate, flat or revolute. Stamens with the filaments 2.5–3.8 mm long, 0.4–0.7 mm wide; anthers with locules 2.0 mm long, the wings 2.0–2.3 mm long and 0.5–0.7 mm wide, the apical appendage of the connective 0.6–0.8 mm long. Ovary conical, 1.0 mm high, covered with basifixed hairs 2.0 mm long; styles 4.0–5.5 mm long, glabrous; stigma slightly internal. Cocci 7.0–8.0 mm long, 7.0–8.0 mm wide, spheroid, ventrally flattened, apically rounded, with an inflated rim at the base, sparsely hairy, densely so below the apex; seed more or less filling the coccus at maturity.

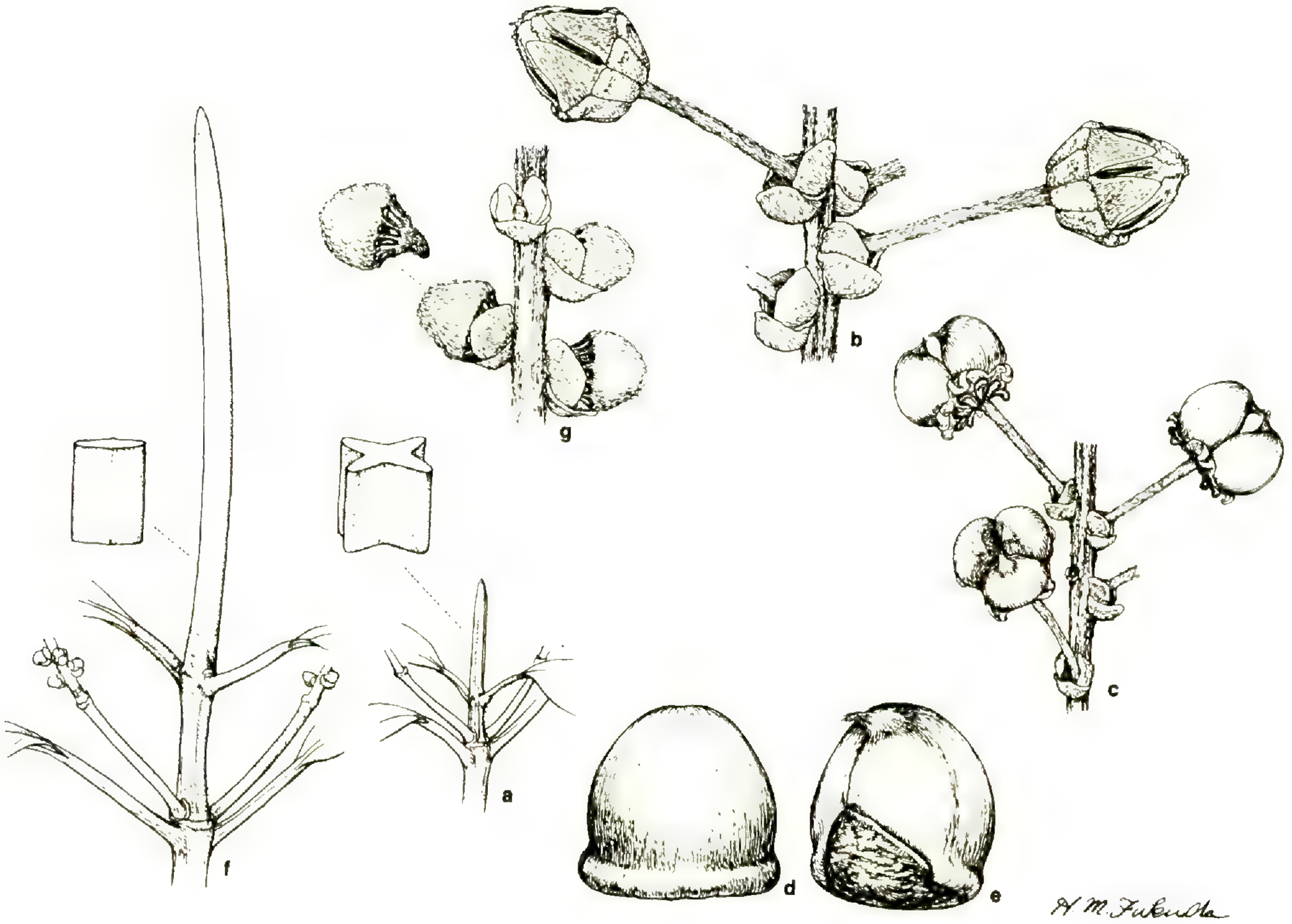

FIG. 1. *a-e, Acmanthera latifolia*: *a,* stipules and base of leaves and inflorescence, ×0.5; *b,* section of inflorescence in bud, ×2.5; *c,* section of inflorescence in fruit, ×1; *d,* coccus, dorsal view, and *e,* coccus, ventral view, ×5. *f-g, Acmanthera duckei*: *f,* stipules and base of leaves and inflorescence, ×0.5; *g,* section of inflorescence in young bud, ×2.5. (*a-b* drawn from *Prance et al. 11753, c-e* from *M. Silva et al. 147, f-g* from *Ducke s.n.* [MG#9034].)

TYPE: BRAZIL: Pará: *sine loc., sine num.* (P, not seen).

BRAZIL: Amazonas: Rio Negro, Paraná do Ubim, várzea, terra firme, 31-I-1959, *Cavalcante 491* (MG, NY); Manaus, Tarumãzinho, igapó, água preta, 15-VII-1955, *Coelho s.n.* [INPA #1405] (INPA, MG, SP); Manaus, margem esquerda do Rio Negro, terra firme, arenosa, capoeira fechada, alta, 16-I-1956, *Coelho s.n.* [INPA#3327] (IAN, INPA, MG, SP); Janauarí, boca do Rio Negro, terra argilosa, mata virgem, várzea, 27-II-1956, *Coelho & Mello s.n.* [INPA#3510] (IAN, INPA, MG); Rio Cuieiras, igapó, 2-IV-1959, *Coelho s.n.* [INPA#7250] (IAN, INPA, SP); Rio Negro, Barcellos, beira do rio, 13-VI-1905, *Ducke s.n.* [MG#7118] (MG); baixo Rio Negro, boca do Taruman, beira alagada, 26-IV-1911, *Ducke s.n.* [MG#11565] (MG); Manaus, Igarapé da Cachoeira Grande, igapó, 18-IV-1937, *Ducke 460* (MG, NY); Rio Negro, Barcelos, igapó, 28-IV-1952, *Fróes 28356* (IAN, UB); margin of Rio Negro opposite Manaus, 3–6 km upstream, igapó, 8-IV-1971, *Prance et al. 11753* (F, INPA, K, MICH, NY, S, U, US); Rio Negro, Paraná-ubim, várzea, 31-I-1959, *J. Rodrigues 12* (IAN, UB); Cacau Pirêra, igapó de solo argiloso, 20-III-1961, *W. Rodrigues & Lima 2257* (INPA, SP); Lago do Janauarí, boca do Rio Negro, igapó, 2-VI-1961, *W. Rodrigues et al. 2715* (INPA, SP); Manaus, estrada do Aleixo, Km. 14, porto Mauá, igapó à margem do igarapé, 23-IV-1970, *W. Rodrigues 8841* (INPA); Paraná da Eva, Rio Preto da Eva, mata da várzea alagavel, *M. Silva 870* (MG, NY); Paraná da Eva, Rio Preto da Eva, lago Arumã, terreno alagavel, 15-IV-1967, *M. Silva 891* (MG, NY); Manaus, Porto Mauá, 26-V-1972, *M. Silva et al. 147* (INPA); Prov. Rio Negro, in vicinibus Barra [=Manaus], XII-1850–III-1851, *Spruce 1901* (MG, NY); secus Rio Negro, inter Barra et Barcellos, XI-1851, *Spruce 1903* (MG).

2. **Acmanthera duckei** W. R. Anderson sp. nov. Fig. 1.

Arbor parva ramulis junioribus adpresso-sericeis; ramis vetustioribus glabratis. Folia novella adpresso-sericea, sero glabrescentia; lamina 22–32 cm longa, 11–16.5 cm lata, late elliptica, prope medium latissima, basi cuneata, apice obtusa (?) vel

brevi-acuminata, margine plana, integra vel distaliter parum repanda; petiolo 3.0–4.0 cm longo; stipulis 11–12 cm longis, abaxialiter adpresso-sericeis, ut videtur inter- et intrapetiolariter omnino connatis, vagina stipulacea suturas intrapetiolares praebenti, complanata, in sectione transversali angustissime elliptica. Inflorescentia gemmifera 8–11 cm longa, piloso-sericea; internodio sub inflorescentia 2.5–3.2 cm longo, adpresso-sericeo; bracteis 3.3–3.6 mm longis, 3.5–4.0 mm latis, orbicularibus, profunde concavis, abaxialiter centro dense sericeis versus marginem membranaceis glabrisque, interdum glabrescentibus, nervis compluribus inter se parallelis connexisque adaxialiter prominentibus; bracteolis bracteis similibus, parum minoribus, 2.5–3.5 mm longis, 2.5–3.3 mm latis; bracteis bracteolisque deciduis (?); pedicellis gemmiferis 3 mm longis, 1 mm diametro, piloso-sericeis. Calyx (gemmae) glandibus 2.5 mm longis; lobis 3.0 mm longis, 2.6 mm latis. Petala obovata, abaxialiter dense sericea, denticulata. Antherae alis loculos valde superantibus (in gemma), connectivi appendicula apicali crassa et bene evoluta. Ovarium pilis rectis basifixis dense vestitum; stylis basaliter piliferis; stigmate apicali. Fructus ignotus.

TYPE: BRAZIL: Pará: Rio Mapuera, abaixo da Cachoeira da Egua, 4-XII-1907, *Ducke s.n.* [MG#9034] (MG, holotype; R, isotype).

This species is known only from the type, and unfortunately that has no open flowers. For this reason, various floral characters have had to be omitted or qualified. It is clearly closely related to *A. latifolia,* but they differ in characters of the stipules, leaves, bracts, and bracteoles. Other characters will probably be evident when the species is collected with open flowers and fruits. The leaves of the type are very large and more or less glabrescent, but it remains to be seen how reliable these characters will be.

This species is named in honor of Adolpho Ducke, 1876–1959, renowned botanist of Amazonian Brazil.

3. **Acmanthera cowanii** W. R. Anderson sp. nov. Fig. 2.

Frutex (vel arbor?) ramulis junioribus brunneo- vel albo-adpresso-sericeis; ramis vetustioribus glabratis, lenticelliferis. Folia novella adpresso-sericea, mox glabrata praeter costam petiolumque, etiam petiolo demum glabrescenti; lamina 9.0–22.5 cm longa, 3.0–11.5 cm lata, elliptica obovatave, saepe supra medium latissima, basi acuta obtusave, apice obtuse acuminata, acumine 4–6 mm longo, margine plana, nunc integra nunc repanda praesertim distaliter; petiolo (1.2–)2.0–3.0 cm longo; stipulis 6.0–8.3 cm longis, abaxialiter adpresso-sericeis, adaxialiter villosis, inter- et intrapetiolariter connatis in 5 mm proximalibus et distinctis distaliter, exduplicato-valvatis, vagina stipulacea in sectione transversali cruciformi. Inflorescentia 11–20 cm longa, atrobrunneo-piloso-sericea; internodio sub inflorescentia 5–8 cm longo, brunneo- vel albo-adpresso-sericeo; bracteis 1.0–1.6 mm longis, 0.5–0.9 mm latis, aliquantum anguste triangularibus, planis, saepe reflexis, proximaliter pubescentibus, distaliter glabris vel paucipiliferis, membranaceis, costa sola evoluta ipsaque obscura; bracteolis bracteis similibus, plerumque minoribus; bracteis bracteolisque persistentibus; pedicellis 3–7(–9) mm longis, 0.5–0.7 mm diametro, piloso-sericeis. Calyx glandibus 2.5–3.5 mm longis, apice parum revolutis; lobis 3.0 mm longis, 2.0–2.6 mm latis, sub anthesi revolutis. Petala alba, glabra vel in costa abaxiali sparsim sericea. Petala quatuor laturalia mox reflexa, ungue 1.0–1.5 mm longo, limbo 3.0–3.7 mm longo, 1.6–2.0 mm lato, spathulato vel anguste obovato, revoluto, eroso. Petalum posticum erectum (sero reflexum), ungue 1.5–2.4 mm longo, crasso, limbo 2.8–4.0 mm longo, 2.0–3.1 mm lato, late elliptico, plano, glanduloso-denticulato. Stamina filamentis 2.5–3.0 mm longis, 0.5–0.6 mm latis; antherarum loculis 1.6–2.0 mm longis; loculorum alis 1.6–2.0 mm longis, 0.4–0.5 mm latis; connectivi appendicula apicali 0.5–1.1 mm

FIG. 2. *Acmanthera cowanii*: *a*, habit, ×0.5; *b*, stipular sheath in cross-section, ×2; *c*, opening flower bud, ×5; *d*, flower, ×2.5; *e*, flower, ×5; *f*, sepal and stamens, dorsal view, ×5; *g*, stamens, ventral view with ovary removed, ×5; *h-j*, anthers in lateral (*h*), dorsal (*i*), and ventral (*j*) views, ×10. (Drawn from *Cowan 38597*.)

longa. Ovarium conicum, 1.3 mm altum, pilis brevibus adpressis basifixis sericeum; stylis 3.6–5.5 mm longis, basaliter et sparsim distaliter piliferis; stigmate apicali vel parum interno. Fructus ignotus.

TYPE: BRAZIL: Terr. Amapá: Rio Amapari from Serra do Navio Camp to Porto Terezinha, left bank; 25-XI-1954; *Cowan 38597* (IAN, holotype; F, MICH, NY, U, US, isotypes). PARATYPE: BRAZIL: Pará: Rio Jamundá [Nhamundá], perto da fóz do Paranapitinga, beira, varzea, 16-V-1911, *Ducke s.n.* [MG#11749] (MG, RB).

The label on Cowan's collection describes the plant as a liana, but it is probable that Ducke's hand-written field note of "Arb." (*arbusto, i.e.* shrub) is correct. The species will probably eventually be found to grow as a shrub or tree.

The two collections differ in a number of characters, most significant of which is the apical appendage of the connective, which is twice as long in the type as in the collection by Ducke. Also, the petals are sparsely hairy in the type and apparently glabrous in the paratype. However, the overall similarity of the plants is so great as to make it very likely that they are conspecific.

This species is named for Richard S. Cowan, (1921–), collector of the type and specialist in the taxonomy of Leguminosae.

Acmanthera sect. **Microglossa** W. R. Anderson sect. nov.

Acmanthera nervis lateralibus primariis laminae subparallelis, versus marginem arcuatis; nodo sub inflorescentia plerumque duo folia persistentia gerenti; gemma juveni sepalis iam separatis, ideo petalis visibilibus; sepalis orbicularibus, apice late rotundatis, abaxialiter centro basique piloso-sericeis et versus apicem vel marginem glabris, adaxialiter glabris; connectivi appendicula apicali usque ad 0.3 mm longa, plana, membranacea, apice acuta eglandulosaque.

TYPE: *Acmanthera parviflora* W. R. Anderson.

The name of this section refers to the small size of the appendage borne at the apex of the connective.

4. **Acmanthera parviflora** W. R. Anderson sp. nov. Fig. 3.

Arbor 4 m alta; ramulis junioribus brunneo-piloso-sericeis, sparsim lenticelliferis; ramis vetustioribus glabratis. Folia novella piloso-sericea, adulta sparsim sericea vel glabrata; lamina vegetativa 12–23 cm longa, 4–9 cm lata, elliptica obovatave, saepe supra medium latissima, basi attenuata, apice abrupte acuminata, acumine 5–8 mm longo, margine plana vel parum revoluta, integra; petiolo 0.8–1.5 cm longo; stipulis 4–5 cm longis, abaxialiter piloso-sericeis, adaxialiter glabris, inter- et intrapetiolariter omnino connatis, vagina stipulacea complanata, in sectione transversali angustissime elliptica. Inflorescentia 11–14.5 cm longa, sericea vel piloso-sericea, pilis pallidioribus quam pilis ramulorum; internodio sub inflorescentia 1.5–4 cm longo, atrobrunneo-piloso-sericeo; foliis sub inflorescentia foliis vegetativis similibus sed minoribus, lamina 3.5–9.0 cm longa, 0.7–1.7 cm lata, petiolo 0.4–0.6 cm longo; bracteis 0.3–0.6 mm longis, 0.3–0.6 mm latis, triangularibus vel ellipticis, planis, basi glanduloso-callosis, saepe reflexis, glabris, membranaceis, ut videtur sine nervis; bracteolis bracteis similibus, plerumque minoribus praesertim angustioribus; bracteis bracteolisque deciduis (?); pedicellis 5–10 mm longis, 0.3–0.5 mm diametro, sericeis vel piloso-sericeis. Calyx glandibus 1.5 mm longis, apice non revolutis; lobis 1.5–2.0 mm longis, 1.2–1.5 mm latis, sub anthesi revolutis. Petala "albido-rosea" vel "flava," glabra vel in costa abaxiali paucipilifera; ungue 1.0–1.2 mm longo; limbo 2.5–2.9 mm longo, 2.0–2.5 mm lato,

FIG. 3. *Acmanthera parviflora*: *a*, habit, ×0.5; *b*, stipular sheath in cross-section, ×1.5; *c*, flower, ×2.5; *d*, flower, ×5; *e*, sepal and stamens, dorsal view, ×10; *f*, stamens, ventral view with ovary removed, ×10; *g-i*, stamens in lateral (*g*), ventral (*h*), and dorsal (*i*) views, ×15. (Drawn from *Fróes 25200*.)

minute denticulato. Petala quatuor lateralia mox reflexa, limbo obovato. Petalum posticum erectum, ungue crassiore, limbo orbiculari. Stamina filamentis 1.0–1.5 mm longis, 0.4–0.6 mm latis; antherarum loculis 0.8–1.0 mm longis; loculorum alis 0.7–1.0 mm longis, ca. 0.2 mm latis; connectivi appendicula apicali 0.2–0.3 mm longa, 0.2 mm lata, triangulari, inflexa. Ovarium 1.0 mm altum, pilis sub-basifixis dense pilosum; carpellis sphaeroideis; stylis ca. 2.5 mm longis, sparsim piliferis; stigmate apicali. Fructus ignotus.

TYPE: BRAZIL: Amazonas: Rio Urubú, terra baixa, ao longo do rio, 12-IX-1949, *Fróes 25200* (IAN, holotype; UB, isotype). PARATYPE: BRAZIL: Amazonas: Estrada Manaus–Itacoatiara, Km 195, picada 27 na margem do Rio Urubú, igapó, 22-XI-1965, *Rodrigues & Coelho 7293* (INPA).

Both collections of this distinctive species are from low, wet forests near the Rio Urubú *ca* 3° S, 59° W. That area has produced several undescribed species and would probably repay intensive collecting.

The color of the petals remains in doubt. The label with Fróes's collection says "flôres roseo-esbranquiçadas," while that of Rodrigues and Coelho says "flôres amarelas." Since the latter is mostly in bud, perhaps the petals are pale yellow in bud and white or pinkish in the open flowers; such a shift in color does occur in some Malpighiaceae.

The epithet refers to the small flowers, the smallest known for the genus.

5. **Acmanthera longifolia** Niedenzu, Arb. Bot. Inst. Ak. Braunsberg 5: 32. 1914.

Tree 6 m tall, the trunk 8 cm in diameter; branches glabrous, prominently lenticellate. Leaves glabrous; lamina of the vegetative leaves 23–35 cm long, 7.5–15 cm wide, elliptic, broadest at or above the middle, acute at the base, usually abruptly acuminate at the apex, the acumen *ca* 1–1.5 cm long, entire at the margin; petiole 1.5–2 cm long; stipules 6.0–6.7 cm long, glabrous on both sides, completely and strongly connate inter- and intrapetiolarly, the whole sheath strongly flattened, narrowly elliptic in cross-section. Inflorescence 11–17 cm long, pilose-sericeous; internode subtending the inflorescence 2.5–7.5 cm long, glabrous; leaves subtending the inflorescence similar to vegetative leaves but smaller, the lamina 13–21 cm long and 4–6.5 cm wide, the petiole 1.0–1.5 cm long; bracts and bracteoles 0.6–0.9 mm long, 0.2–0.4 mm wide, subulate or triangular, membranous, with only an obscure midrib, glabrous, eventually deciduous; pedicels (in fruit) 1 cm long, *ca* 0.7 mm in diameter, pilose-sericeous. Calyx (in bud) with glands 3.5–4.0 mm long, lobes 1.0–1.5 mm long, 2.5–3.0 mm wide. Petals white, glabrous, orbicular, about as wide as long, entire. Connective of the anther (in bud) bearing a rudimentary subulate apical appendage *ca* 0.3 mm long. Ovary glabrous; styles glabrous; stigma apical. Cocci 9–10 mm long, 7–8 mm wide, ovate or spheroid, ventrally flattened, apically obtuse, smooth and without an enlarged rim at base, glabrous.

TYPE: BRAZIL: Amazonas: Prov. Rio Negro, prope Barra [=Manaus], 1855, *Spruce 3838* (NY, isotype). Other collection studied: BRAZIL: Amazonas: Manaus and vicinity, Cachoeira baixa Tarumã, beside river, 2-I-1967, *Prance et al. 3854* (F, INPA, K, MICH, NY, P, S, U, US).–This is the second known collection of the species and the first with flowers.

Of the two collections available to me, one is in advanced fruit and the other is in young bud. Therefore many measurements have been left out (*e.g.* petal dimensions), and others have been qualified ("in bud") to warn the reader that when open flowers are found the measurements will differ.

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NOTES ON BANISTERIOPSIS FROM SOUTH-CENTRAL BRAZIL[1]

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The genus now called *Banisteriopsis* is one of the largest genera in the Malpighiaceae, comprising about 100 species. It was first circumscribed in the modern sense by Adrien de Jussieu, under the name *Banisteria* L., and that name was generally applied to this group during the century between Jussieu's first publication on Malpighiaceae in 1833 and Franz Niedenzu's monograph of the family in 1928. Unfortunately, the species that comprised *Banisteria* in the *Species Plantarum* of Linnaeus (1753) did not include any referable to the genus as circumscribed by Jussieu and Niedenzu. Proposals by Morton (1967) and Anderson (1967) to conserve *Banisteria* in the sense of later authors were rejected (McVaugh, 1968), and so it is necessary to employ the name *Banisteriopsis* Robinson *ex* Small for this genus. Some combinations have already been published in *Banisteriopsis*, most notably by Cuatrecasas (1958). Many other new combinations will eventually become necessary, but we reject the expedient of a wholesale transfer of names, some of which may not deserve recognition as species. The junior author is now studying the large, natural section of the genus that contains the pink- and white-flowered species and is centered in the Planalto of south-central Brazil. She will publish new combinations for that group at the termination of her study. The purpose of this paper is to publish new combinations for four yellow-flowered species from the Planalto and to describe another from lowland Bahia east of the Planalto.

Banisteriopsis valvata Anderson et Gates sp. nov. Fig. 1.

Liana lignosa 3.5 m in dumeto attingens; ramis junioribus complanatis, brunneo-sericeis, vetustioribus teretibus, albido-sericeis vel glabrescentibus. Folia opposita, sensim in inflorescentiam redacta; lamina 5.0–15.0 cm longa, 4.0–14.5 cm lata (vel in inflorescentia minori), orbiculari vel late ovata, basi truncata subcordatave, apice obtuse brevi-acuminata, margine plana integraque, eglandulosa vel prope basim 1–2 glandes marginales sessiles vel stipitatas gerenti, nervis lateralibus venis parallelis connexis, venis venulisque subtus prominentibus, supra obscuris, supra pubescenti mox glabrata, pilis longius in nervis persistentibus, subtus pertinaciter tomentosa, pilis albis, tenuibus, trabecula 0.7–0.9 mm longa, recta vel saepius flexuosa, pede ca. 0.1 mm longo; petiolo 1.0–3.7 cm longo, sericeo vel glabrescenti, supra medium (plerumque 1–3 mm infra apicem) 2 glandes cylindraceas ca. 1 mm longas gerenti; stipulis dissectis, seriem structurarum aliquot triangularium 0.3–1.0 mm altarum inter bases petiolorum facientibus. Inflorescentia atrobrunneo-sericea, paniculata, floribus in umbellis 3- vel 4-floriferis fasciculatis; bracteis bracteolisque 1.5–2.0 mm longis, 0.7–1.1 mm latis, triangularibus vel ovatis, abaxialiter sericeis, adaxialiter glabris, persistentibus; pedunculis 0–1.0 mm

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FIG. 1. *Banisteriopsis valvata*: *a,* habit and inflorescence, with larger vegetative leaf, ×0.5; *b,* flower bud, ×2.5; *c,* flower, with innermost (posterior) petal to right, ×1.5; *d,* androecium and gynoecium, posterior view with shortest stamen (that opposite the posterior petal) in foreground, ×5; *e,* androecium and gynoecium, lateral view, ×5; *f,* gynoecium, ×5; *g,* young fruits enclosed by accrescent sepals, ×0.5; *h,* immature fruit, lateral view, ×1.5. (Drawn from *Anderson et al. 36981* by Karin Douthit.)

longis; pedicellis 9–19 mm longis, 0.8–1.0 mm diametro, atrobrunneo-sericeis. Sepala 5, 6.5–8.0 mm longa, 5.5–6.5 mm lata, 2–3 mm proximalibus connata, eglandulosa, late ovata, basi cordata vel subcordata, apice obtusa, exduplicato-valvata, post anthesin adpressa, abaxialiter atrobrunneo-sericea, pilis medifixis, adaxialiter versus marginem minute albo-lanata, pilis brevibus, tortuosis, basifixis, centro basique glabra, in fructu accrescentia, 16 mm longa et 12 mm lata in fructu immaturo. Petala 5, lutea, limbo margine laciniato eglandulosoque, abaxialiter tenuiter sparsimque albo-sericeo. Petala 4 lateralia inter sepala patentia, ungue 4.0–5.0 mm longo, 0.5–0.6 mm diametro, limbo 10.0–14.0 mm longo latoque, orbiculari, plano, 2 anterioribus quam 2 posterioribus parum majoribus. Petalum posticum erectum, ungue 4.0–4.5 mm longo, 1.1–1.7 mm diametro, apice constricto, limbo 8.2–10.0 mm longo, 6.0–9.0 mm lato, late elliptico, obovato, vel orbiculari, saepe corrugato. Receptaculum glabrum. Staminum 10 filamenta 0.3–0.7 mm proximali connata, glabra, illud sepalo antico oppositum 4.5 mm longum, illa 8 lateralia 3.0–3.5 mm longa, illud petalo postico oppositum 2.0 mm longum, illa sepalo antico et petalis lateralibus opposita crassa rectaque, illa sepalis lateralibus et petalo postico opposita distaliter tenuia, postice flexa. Antherae subaequales, glabrae, reflexae, deciduae; loculis 1.0–1.5 mm longis, in connectivo distantibus; connectivo loculos 0.4–0.8 mm superanti, globulari, papilloso, antherarum sepalis oppositarum quam petalis oppositarum longiore latioreque. Ovarium 1.5 mm altum, carpellis 3, uniovulatis, liberis, toro pyramidali adnatis, velutinis. Styli 3, subaequales, 4.0–5.0 mm longi, graciles, stigmate capitato, basi adaxiali barbati (anticus densius), pilis albis vel brunneis, rectis vel flexuosis, basifixis vel sub-basifixis; 2 postici recti, paralleli, versus petalum posticum inclinati, anticus saepe versus sepalum anticum inclinatus, rectus vel parum curvatus. Fructus ex 3 samaris (vel abortu 1–2) constans. Samara immatura sine carpophoro, hispida pilis sub-basifixis et 1.5 mm longis, necnon sericea pilis tenuioribus et plus minusve medifixis; ala centrali 20 mm longa, 9 mm lata, adaxialiter incrassata, basi appendiculam triangularem 5 mm latam altamque gerenti; alis lateralibus in quoque latere 2 vel 3, extimis 8 mm altis, 16 mm longis, et apice et basi liberis, secundis 9 mm altis, 10 mm longis, apice liberis, basi semiconnatis, tertiis parvis, prope basim alae centralis reconditis vel in cristas redactis.

TYPE: BRAZIL. Bahia: shrubby woods on hills of gentle slope, ca. 13 km S of Cocos and 3 km S of the Rio Itaguarí, elev. 560 m, 15-III-1972, *Anderson, Stieber, & Kirkbride 36981* (UB, holotype; F, IAN, K, MICH, MO, NY, P, RB, SP, U, US, isotypes).

This species is allied with *Banisteriopsis heterostyla,* with which it shares these characteristics: cylindrical glands on the petiole, axillary inflorescences, eglandular sepals, fimbriate petals with long claws, slender, basally bearded styles, glabrous anthers, lateral wings and an anterior appendage on the fruit, and stiff hairs on the fruit. *Banisteriopsis valvata* is notable for its nearly glabrous petals, the valvate aestivation of its sepals (to which the epithet refers), and the great enlargement of the calyx in fruit.

Banisteriopsis clausseniana (Adr. Juss.) Anderson et Gates comb. nov.

Banisteria clausseniana Adr. Juss. *Malp.* Synopsis *in* Ann. sc. nat. 2. sér. Bot. 13: 285. 1840. TYPE: Minas Gerais: "Caxoeira do Campo," *Claussen s.n.* (P).

Niedenzu (1928, p. 411) cited as possible synonyms the older names *Banisteria macrostachia* Vell. (1829) and *B. anisandra* Juss. (1833). Vellozo's description and plate are not adequate for identification of his plant, even to genus, but his description of the habitat as "sylvis maritimis" makes it very unlikely that he was describing *B. clausseniana.* The available descriptions of *B. anisandra* are also inadequate for its identification. Jussieu clearly felt that it and *B. clausseniana* were distinct species, since

he maintained both in his monograph of the family (1843). Examination of the types in Paris should allow resolution of this problem.

Niedenzu applied this name to plants from São Paulo, Minas Gerais, Bahia, and Goiás. The modern collections which we have seen are from Minas Gerais, Goiás, and the present Distrito Federal.

Banisteriopsis gardneriana (Adr. Juss.) Anderson et Gates comb. nov.

Banisteria gardneriana Adr. Juss. Monogr. *Malp. in* Arch. Mus. 3: 421. 1843. TYPE: Piauí: [Prov. Paranagoa *fide* Niedenzu] *Gardner 2502* (P, holotype, K! NY! isotypes).

Niedenzu (1928, p. 409) cited as a possible synonym the older name *Banisteria aurea* Vell. (1829). Vellozo's description and plate are not adequate for identification of his plant, but his description of the habitat as "fruticetis maritimis," presumably in the region of Rio de Janeiro, makes it unlikely that he was describing *B. gardneriana.*

Niedenzu cites under this name specimens from a wide variety of localities, and it is possible that they represent more than one species. We are applying the name to collections from Minas Gerais, Goiás, the Distrito Federal, and southernmost Piauí.

Banisteriopsis hypericifolia (Adr. Juss.) Anderson et Gates comb. nov.

Banisteria hypericifolia Adr. Juss. *in* St. Hil. Fl. bras. mer. 3: 42. 1832 [1833]. TYPE: Minas Gerais: Sobrado, *St. Hilaire* (P).

Banisteria rigida Adr. Juss. *Malp.* synopsis *in* Ann. sc. nat. 2. sér. Bot. 13: 284. 1840. TYPE: Minas Gerais: Tijuco [= Diamantina], *Vauthier* (P).

Most collections of *B. hypericifolia* have been made in or near the Serra do Espinhaço in Minas Gerais; we have also applied the name to one collection from western Bahia (*Fryxell 1960,* NY). Niedenzu cites a collection from São Paulo under *B. rigida,* but we have not seen it and cannot evaluate the identification at this time.

In the area of Diamantina, Minas Gerais, one can find shrubby, non-twining plants with the flowers of *B. hypericifolia* but with small narrow leaves and few-flowered inflorescences. Such plants have been named *Banisteria rigida,* and they do seem very different from *B. hypericifolia,* which generally has wand-like stems that twine at the tips, large leaves, and dense inflorescences. However, observations in the field have convinced us that these are the same species. The first sprouts after a fire are "typical" *B. hypericifolia,* and because of their stature and profusion of flowers they are much collected. When protected from fire, the plants eventually assume the shrubby habit and other characters of *B. rigida.* Careful search reveals many plants with intermediate characters, and sometimes one encounters "hypericifolia" shoots from the base of a burned skeleton of "rigida."

Banisteriopsis virgultosa (Adr. Juss.) Anderson et Gates comb. nov.

Banisteria virgultosa Adr. Juss. *Malp.* synopsis *in* Ann. sc. nat. 2. sér. Bot. 13: 284. 1840. TYPE: Minas Gerais: Chapada do Paranan [= Paranã], alibi ad Rio Hermoso, *Martius* (M).

This species is closely related to *B. hypericifolia,* from which it differs in these characters: habit of a liana, inflorescence axillary to full-sized leaves, branches and pedicels sericeous, sepals densely sericeous, ovary densely hairy, nut of the fruit smooth and densely sericeous. The two collections which we have seen are from western Bahia (*Anderson et al. 36742,* NY) and northern Goiás (*Prance & Silva 58533,* NY).

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Contr. Univ. Mich. Herb. 11(2):57–63. 1975.

MEXICAN SPECIES OF PEDICULARIS (SCROPHULARIACEAE) HITHERTO CONFUSED WITH P. TRIPINNATA MART. & GAL.

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The large circumboreal genus *Pedicularis* (Scrophulariaceae) is represented in Mexico by comparatively very few species. As late as the publication of Hemsley's treatment in the *Biologia Centrali-Americana* (Bot. 2: 467. 1882) only four distinctively Mexican species were listed, *viz. P. angustifolia* Benth., *P. mexicana* Zuccar., *P. orizabae* Cham. & Schlecht., and *P. tripinnata* Mart. & Gal. These were traditionally separated by characters of leaves and flowers, more or less as follows:

1. Leaves linear, undivided.	*P. angustifolia*
1. Leaves pinnately parted.	
2. Leaves 1-pinnate, the segments incised-dentate.	*P. mexicana, P. orizabae*
2. Leaves 2–3-pinnate.	*P. tripinnata*

The degree to which leaves are dissected varies considerably from plant to plant in these and other species of *Pedicularis,* and so the distinction between "pinnately parted" leaves and "2–3-pinnate" leaves is not always an easy one. As a result, the name *Pedicularis tripinnata* has been loosely applied on occasion to various sterile or fruiting specimens having relatively finely cut leaves. In the protologue of *P. tripinnata,* the corolla was described as "pollicaris rubro-purpurea," with "galea obtusa truncata sub apice 2–4-dentata." Unfortunately no flowering material was available to Bentham when he was preparing the treatment of the genus for the DeCandolle *Prodromus*; he saw in Hooker's herbarium a specimen of the type-number (*Galeotti 1063*), but without flowers. He was therefore uncertain of the identity of the species and, in fact, did not mention it in the *Prodromus,* merely citing the Galeotti specimen as perhaps different from *P. mexicana.* Very probably he did not know of the publication of *P. tripinnata* (1845) before the printing of his *Prodromus* manuscript, which was published 8 April 1846. As far as we know, no other collector obtained identifiable specimens of *P. tripinnata,* after the original collection by Galeotti before 1840, until the plant was found by C. G. Pringle near Pátzcuaro, Michoacán, in 1892. We have recently had the favor of the loan of two isotypes, duplicates of *Galeotti 1063,* the one from Kew (K) already mentioned, and another, a flowering specimen, from Paris (P). There can be no doubt that Pringle's no. 4156 represents the same species; it is, in fact, a rather common plant in western Mexico. It transpires, however, that in the same region there are three distinctive taxa belonging to the same genus, all with dissected and sometimes 2–3-pinnate leaves.

Beginning about 1934, with the explorations of F. W. Pennell, and in 1939 with those of G. B. Hinton, specimens of another *Pedicularis* with dissected leaves have been found at various localities in the mountainous regions from Durango to Michoacán. Pennell tentatively called his specimen *"Pedicularis tripinnata,"* and subsequent collectors have accepted this determination to a considerable extent, but Pennell's plant, and that of Hinton, have proved to represent an undescribed species that we are calling *Pedicularis glabra.* In spite of some superficial resemblances between the leaves of *P.*

glabra and those of *P. tripinnata,* the two are not closely related within the genus. *P. glabra* belongs to the very small but distinct Sect. *Longirostres* Benth. (*in* DC. Prodr. 10: 566. 1846), sometimes treated as a distinct genus, *Elephantella* Rydb. In contrast, *P. tripinnata* and the other new species described below are apparently most similar to a small group of American species (*e.g. P. densiflora* Benth., of California) having the corolla essentially straight, clavate, without any appreciable curving or lateral extension of the galea at the tip.

A revised key to the Mexican species of *Pedicularis* with pinnately parted or dissected leaves may be presented as follows:

1. Plants glabrous or essentially so; galea prolonged into a curved beak, or at least curved and enlarged into a distinct point on the lower (abaxial) side.
   2. Galea prolonged into a linear, recurved-ascending beak 5–7 mm long; lower lip inconspicuous, more or less clasping the base of the galea, its lateral divisions only 1.5–2.5 mm wide; leaves often 2–3-pinnately parted. *P. glabra*
   2. Galea abruptly or gradually downwardly curved, short-beaked or merely enlarged and pointed on the lower side; lower lip broad, spreading or at most loosely enveloping the galea, its lateral divisions 3–8 mm wide; leaves commonly once pinnately parted, with short-toothed segments.
      3. Lobes of the lower lip 7–8 mm wide, often as long as the galea; galea abruptly incurved nearly at a right angle, narrowed beyond the curve into a short truncate beak. *P. mexicana*
      3. Lobes of the lower lip 3–4 mm wide, much shorter than the galea; galea smoothly incurved from the adaxial side, the beak obsolete, scarcely prolonged beyond the curve. *P. orizabae*
1. Plants evidently pilose; galea clavate, rounded at apex, neither beaked, curved nor enlarged to a point at one side.
   4. Leaves almost all basal; plants 10–30(–60) cm high; calyx 6–8 mm long; corolla about 2.5 cm long; roots tuberous-thickened; flowering June and July; Edo. de México to Jalisco. *P. tripinnata*
   4. Leaves cauline, extending to the base of the inflorescence; plants more than 1 m high; calyx 11–16 mm long; corolla 4–4.5 cm long; roots unknown; flowering and fruiting in November; Sierra Madre del Sur, Guerrero. *P. hintonii*

1. **Pedicularis glabra** McVaugh et Mellichamp, sp. nov.

Herba perennis 10–75 cm alta, glabra, caulibus 1–3 erectis simplicibus; folia principalia basalia, (4–)8–20(–27) cm longa, 0.5–5 cm lata, lanceolata vel oblanceolata, bipinnata, pinnulis saepe dentatis; pinnis (8–)15–25, inferioribus in petiolum interdum subalatum 1–7 cm longum interdum ad basin pilosum valde reductis; pinnulorum margines saepe revolutae et calloso-dentatae; folia caulinia saepe 1–3(–4), quam basalia multo minora; racemi laxi, plerumque 15–25(–40) cm longi, 15–30(–60)-flori; pedicelli 3–5 mm longi, erecti vel valde ascendentes; racemi bracteae ascendentes, tripartitae, 8–20 mm longae, lobis calloso-dentatis, lateralibus quam terminali brevioribus; flores 2.5–3 cm longi, calyce campanulato vel ellipsoidali, 5-lobato, tubo (5–)6.5–7.5 mm longo, lobis valde inaequalibus triangularibus acutis, lateralibus unitis (0.8–)1.2–1.5(–1.7) mm longis, lobo dorsali (adaxiali) paullo longiore, marginibus omnis ciliis aggregatis dentes simulantibus instructis; corolla purpureo-rosea (galea atropurpurea, lobi laterales flavi), recurva, bilabiata; labium inferius (abaxiale) 3–6 mm longum, trilobatum, sessile, lobo terminale suborbiculari, (2–)3–4 mm longo latoque, lobis lateralibus suborbicularibus vel quam longioribus latioribus, 2–3.5 mm latis, galeae basi arcte oriundis; labium superius (galea) 9–11 mm longum, supra basin e latere superiore in tubum sublineare recurvo-adscendens truncatum 5–5.7 mm longum abrupte angustatum; stamina 4 didynama inclusa, antheris 2 mm longis; stylus arcuatus, stigmate ad anthesin vix e galeae apice exserto; capsula 13.5–20 mm longa, e basi ad apicem brevirostratum angustata; semina plurima, ovato-compressa, nigrescentia, 2 mm longa, laevia, superficie reticulata.

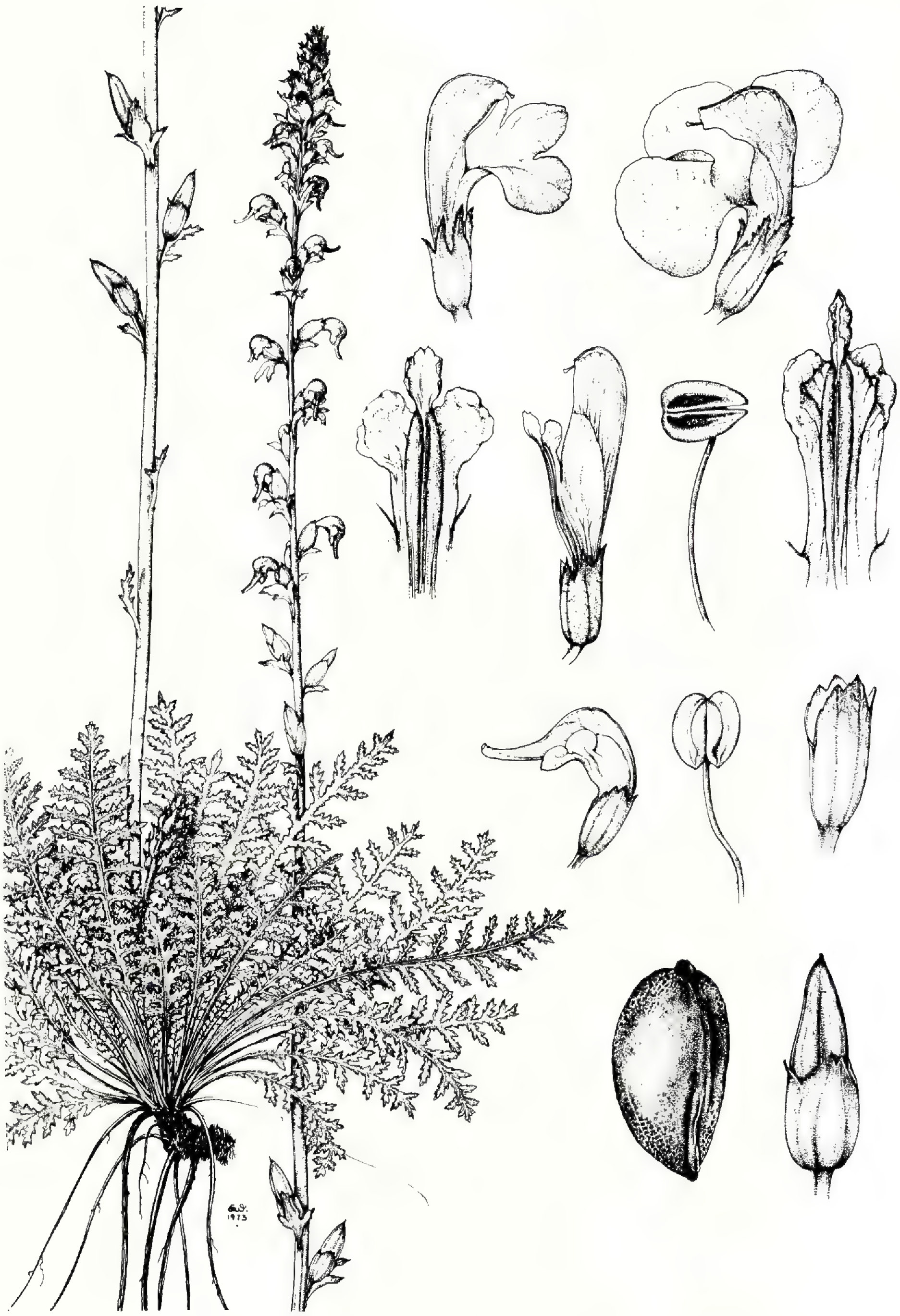

FIG. 1. Mexican species of *Pedicularis*. *P. glabra* (all from the TYPE): Flowering plant at left, ×½; floral details, two rows from bottom (lateral view of flower, ×1.5; anther, ×5; lateral view of calyx, ×2.5; seed, ×15; lateral view of capsule and fruiting calyx, ×1.5). *P. orizabae* (top row, left, from *Pringle 4757*): Lateral view of flower, the position of the lower lip diagrammatic, ×1.5. *P. mexicana* (top row, right, from *Pringle 4197*): Lateral view of flower, the position of the lower lip diagrammatic, ×1.5. *P. tripinnata* (second row, left, from *González 219*): Lower lip of corolla, ×5; lateral view of flower, ×1.5; anther, ×5. *P. hintonii* (second row, far right, from the TYPE): Lower lip of corolla, ×5. (All drawings by Karin Douthit.)

This plant bears a striking resemblance to the widespread boreal species, *Pedicularis groenlandica* Retz. It is also evidently closely akin to a species of the high Andes of Colombia and Ecuador, *P. incurva* Benth. From these it may be separated as follows:

1. Flowers sessile; calyx 4–7 mm long; beak of the galea longer than the expanded part of the corolla; capsule ovoid, about 1 cm long; widespread in boreal America. *P. groenlandica*
1. Pedicels mostly (3–)5–7 mm long, strongly appressed; calyx 7–14 mm long; beak of the galea shorter than the expanded part of the corolla; capsule elongate, 16–25 mm long; western Mexico, northern Andes.
   2. Pressed corolla 5–7 mm wide at the base of the lower lip; beak 5–7.5 mm long; calyx 7–9 mm long, the teeth entire or sometimes callose-toothed; capsule 1.6–1.8 cm long; leaves 2–5 cm wide, 8–25 cm long; Mexico. *P. glabra*
   2. Pressed corolla 3–4 mm wide at the base of the lower lip; beak 4–5.5 mm long; calyx 10–14 mm long, the teeth commonly coarsely callose-dentate; capsule (1.8–)2–2.5 cm long; leaves 1.2 cm wide or less, 10–20 cm long; northern Andes. *P. incurva*

The usual habitat of *Pedicularis glabra* is in pine or pine-oak forest, on moist slopes or near streams, or not infrequently in drier, rocky, or open situations, at elevations from about 2000 m to 2800 m. Flowering begins from late August to mid-October and continues well into November.

Specimens of *P. glabra* examined: MEXICO: DURANGO: Metates, N of Cueva, *Pennell 18444* (F, MICH, US); 10–12 km W of La Ciudad, *Breedlove 15513* (MICH), *18876* (MICH); 10 mi (16 km) W of El Salto, *Straw & Gregory 1269* (MICH), *McVaugh 21746* (MICH); 20 km S of El Salto, *A. G. Gordon 61* (MICH). JALISCO: Sierra de la Campana, NW of Los Volcanes, *McVaugh 13797* (MICH); Sierra de Manantlán, between El Chante and Cuzalapa, near Aserradero El Cuartón, *McVaugh 13834* (MICH, type). MICHOACÁN: Distr. Coalcomán, Barroloso, *Hinton 15370* (MICH, US).

2. **Pedicularis mexicana** Zuccar. *ex* Benth. *in* DC. Prodr. 10: 575. 1846.

Superficially similar, in habit and in leaf-characters, to *P. glabra,* but readily distinguished by the very different flowers. *P. mexicana* is a plant of relatively wetter habitats than those of *P. glabra,* as indicated by collectors' notes: "en lugar pantanoso," "pradera pantanosa," "meadow wet with seepage," "wet roadside ditch," "bogs," "wet meadows," "bog area at upper end of lake," "moist grassy hollow," "in a pond," "soggy llano by stream," "sedgy marsh," "mountain springs," etc. In the highlands of western Durango the two species grow in the same general localities, but in different microhabitats; *e.g.* about 10 miles (16 km) west of El Salto *P. glabra* is "locally abundant in dry, grazed pine woodlands" (*McVaugh 21746*), whereas *P. mexicana,* collected the same day (*McVaugh 21742*) is "abundant in moist meadows in full sun." *P. mexicana* occurs at moderately high elevations (2100–3300 m), commonly begins to flower in July or August, and matures fruit by late August or September. We have seen specimens from western Durango (8), Michoacán (6, including the lectotype, from Angangueo, *Hartweg 355* at K; and from as far west as Pátzcuaro, *Straw & Gregory 1205,* at MICH), Edo. de México (8), D.F. (2), Hidalgo (1), Puebla (1), Tlaxcala (1).

3. **Pedicularis orizabae** Cham. & Schlecht. Linnaea 5: 103. 1830.

This plant is easily confused with *P. mexicana,* from which it differs in measurable flower-characters. It occupies a much more limited range than *P. mexicana* and is found mostly at somewhat higher elevations (3000–3600 m, sometimes as low as 2500 m). It appears to be confined to openings in high pine forests, often among bunch-grasses. We have seen specimens from the Distrito Federal (5, mostly from the

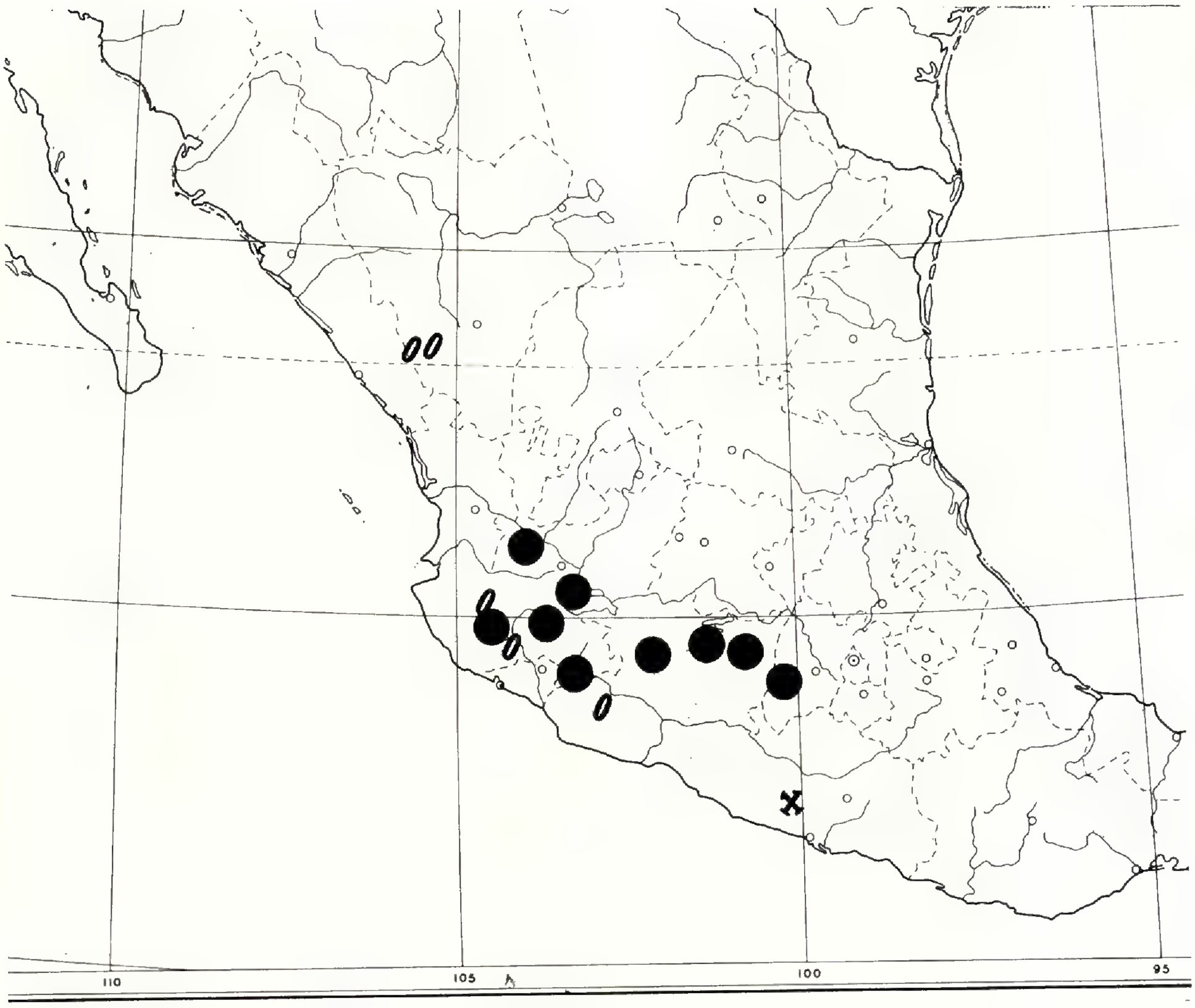

FIG. 2. Distribution of selected Mexican species of *Pedicularis*. Solid circles, *P. tripinnata*. Open ellipses, *P. glabra*. Crossed lines, *P. hintonii*.

Serranía del Ajusco), Veracruz (Pic d'Orizaba [Cueva de Temascal] at 12,000 feet, *Galeotti 1064* at BR, P), and Oaxaca (Cerro, or Sierra, San Felipe, *Andrieux 157* at P, *Pringle 4757* at BR; cordillera E of Oaxaca, *Galeotti 1065* at BR, P).

4. **Pedicularis tripinnata** Mart. & Gal. Bull. Acad. Brux. 12, pt. 2: 34. 1845.

Perennial herbs 20–50 cm tall, with 1–3 stems 2–3(–5) mm thick, from a thickened caudex bearing fusiform, tuberous-thickened roots; plants pilose, especially the lower stem, petioles, and calyces, with whitish flaccid jointed hairs up to 1–1.5 mm long; principal leaves basal, at flowering time (5–)8–15 cm long including a slender petiole 2–10 cm long; rosette leaves after flowering often larger, commonly with blade 12–20 cm long, 7–15 cm wide, on petioles 8–12(–23) cm long; blades 2–3-pinnately divided, pilose especially along the veins beneath, ovate in outline, the lowermost 1–2 pairs of pinnae a little shorter than the upper ones; pinnae at least once-pinnate, the pinnules commonly pinnately incised-dentate; margins commonly revolute, the teeth often callose, whitened; racemes 10–20(–40) cm long, up to 50–75-flowered; bracts foliaceous, 1–2 cm long, oblong to lanceolate or linear, toothed, spreading to reflexed in age; pedicels 3–4 mm long, appressed-ascending; bracteal leaves below the inflorescence sometimes 1–3, rarely a third the size of the basal leaves; flowers about 2.5 cm long; calyx 5-lobed, the tube 4–5.5(–6) mm long, the lobes entire or remotely toothed, (1.5–)2–2.6(–3) mm long, subequal or the dorsal (adaxial) smaller; corolla red, clavate, glabrous, the galea 6–8 mm long, rounded

at apex, the abaxial margins free, straight, the lateral vein on each side sigmoidally curved near the middle of the galea and often ending in a minute tooth at the margin; lower lip erect, 4–5.5 mm long, slightly divergent from the galea, longitudinally plicate with 2 parallel ridges within, trilobate at apex, the lateral lobes suborbicular, ciliolate, 1.5–2 mm wide, the terminal lobe conduplicate, 1.5–2 mm long; anthers 2.5 mm long, crowded into the closed end of the galea; style following the curve of the upper (adaxial) side of the galea, the tip thus recurved, exserted; capsule 11–20 mm long, narrowly ovoid, abruptly apiculate; mature seeds unknown.

In oak or oak-pine forest, in moderately dry places in partial shade, 1500–2800 m elevation, flowering from mid-June to late July, maturing fruit from late July to early September.

Specimens examined: MEXICO: JALISCO: Mpio. Tequila, Cerro de Tequila, *McVaugh 23912* (MICH), *R. González T. 219* (MICH); Sierra de la Campana, W of Los Volcanes, *McVaugh 20042* (MICH); above Amacueca, toward Tapalpa, *McVaugh 20667* (MICH); above San Juan Cozalá, *Puga s.n.* (MICH); Santa Mónica, *McVaugh 14125* (MICH); San Miguel de la Sierra, *McVaugh 22070* (MICH); Sierra del Halo, *McVaugh & Koelz 1171* (MICH). MICHOACÁN: Pátzcuaro, *Pringle 4156* (BR, F, P, US); near Morelia, *Galeotti 1063* (K, P, isotypes); km 234, 10 km E of Mil Cumbres, *Iltis et al. 342* (MICH). MEXICO: Distr. Temascaltepec; Comunidad, *Hinton 965* (US), Nanchititla, *Hinton 6166* (US), Tenayac, *Hinton 4218* (US). LOCALITY UNCERTAIN: "Val. Mexic.," *Keck* [*exsicc.*] *no. 7, ex herb.* C. Mohr [*anno* 1857?] (US).

We were informed by the authorities at Brussels (BR) that no specimen of *Galeotti 1063* could be located there. A suitable lectotype would be the specimen at Paris; the Kew specimen is without flowers.

5. **Pedicularis hintonii** McVaugh et Mellichamp, sp. nov.

Herba perennis simplex 85–110 cm alta, caule basi usque ad 1 cm crasso; radices ignotae; caulis pars inferior, foliorum bases petiolique, et calyces, pilis flaccidis articulatis infuscatis 2–3 mm longis grosse pilosi; folia, praecipue venis majoribus, pilis pallidioribus tenuioribusque instructa; folia ut videtur caulinia et uniformiter disposita, mediana petiolo compresso usque ad 5 cm longo incluso 15–25 cm longa, basi dilatata; laminae 2–3-pinnati-partitae, 5–8 cm latae, ambitu ovatae vel ovato-lanceolatae, pinnis inferioribus paullo minoribus; pinnae utrinque 10–15, lanceolatae, majores basi 2 cm latae, pinnulis inciso-dentatis 5–10 paribus; margines plerumque revolutae, dentibus saepe callosis, dealbatis; bracteae foliaceae, conspicuae, calyces excedentes; inferiores usque ad 10 cm longae, 3 cm latae, in folia caulinia transientes, superiores angustae, inciso-dentatae, 2–3 cm longae; pedicelli glabri, 3 mm longi (fructu 5–6 mm longi), valde appressi vel ascendentes; flores 4–4.8 cm longi; calyx 5-lobatus, 11–16 mm longus, lobis subaequalibus 4–8 mm longis, triangularibus, grosse dentatis; corolla rubra, ca 4.5 cm longa, clavata, glabra, galea 15–17 mm longa, apice rotundata, marginibus abaxialibus rectis, libris, pilis brevibus subglandularibus prope basin instructis, venis lateralibus supra marginum medium in curvamen sigmoidalem terminantibus; labium inferius ca 1 cm longum, longitudinaliter plicatum, e latere ut videtur sublineare, marginibus plusminusve ad porcas duas angustas parallelas contiguas in corollae faucem prolongatas appressis; labium apice trilobatum, lobis lateralibus patentibus denticulatis 1.5 mm longis, terminali paullo longiore incurvato, conduplicato; antherae 3.5 mm longae, in galeae apicem clausum aggregatae; stylus per galeae marginem adaxialem appressus, apice hinc recurvatus, exsertus; capsula (22–)27–29 mm longa, anguste ovoidea, abrupte apiculata; semina matura ignota.

Known only from the Sierra Madre del Sur, Guerrero, Mexico: Distr. Mina, Teotepec, 3200 m, among rocks in pine and fir forest, with flower and young fruit 5 Nov. 1939, *Hinton 14789* (US, type; F).

The relationship of *Pedicularis hintonii* is evidently with *P. tripinnata*; the two are in fact so similar that we at first thought to treat them as subordinate taxa of a single species. Because of the marked differences in size, in pubescence, in leaf-arrangement, leaf-dissection, and geographical ranges of the two, we believe they are best regarded as distinct species, realizing that when *P. hintonii* becomes better known it may prove to be more closely related to *P. tripinnata* than is now apparent.

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REDISCOVERY OF LOBELIA DIELSIANA WIMMER, AND A RELATED SPECIES NEW TO SCIENCE

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The cosmopolitan genus *Lobelia* (Campanulaceae–Lobelioideae), as most recently treated by F. E. Wimmer [Pflanzenreich IV.276b (Heft 107): 408–695. 1953], includes 365 species. One of the classical sections of the genus is *Hemipogon* Benth., proposed in 1869 for those species having the two short anthers (but not the three longer anthers) penicillate-pilose at apex. McVaugh (Amer. Midl. Nat. 24: 681-702. 1940) treated the 34 known North American species of *Hemipogon,* at the same time enlarging the concept to include some species treated by earlier authors under Sect. *Holopogon* Benth., *i.e.* species with all five anthers penicillate-barbate at apex. McVaugh treated those species that were "alike in having blue or purplish flowers, herbaceous and often delicate stems, and tiny ellipsoid seeds which are shining and highly polished or occasionally bearing faint longitudinal lines." McVaugh subsequently treated these species and one additional species newly described, in *North American Flora* 32A: 45–65. 1943. Wimmer (1953) recognized numerous additional species of *Hemipogon* (*sens. str.*), assigning them to subsect. *Leiospermae* Wimmer, and within this to three different groups called *greges* (sing. *grex*).

Recently much new material of *Lobelia* from the Pacific slope of western Mexico has come to hand. This includes several specimens that by Wimmer's treatment would be referred to Subsect. *Leiospermae,* Grex *Eriniformes, i.e.* flowers long-pedicellate in a loose raceme and the leaves mostly cauline. Within *Eriniformes,* Wimmer distinguished six named groups (*Prostratae, Pusillae,* etc.). All our material seems to fall into group *Angustifoliae, i.e.* plants with erect stems, 15–80 cm high, corolla often less than 16 mm long, and leaves entire or toothed, filiform to narrowly lanceolate. Our plants seem furthermore to be referable only to *Lobelia dielsiana* Wimmer, a species known only from imperfect material collected by Langlassé in Guerrero in 1899. In the *North American Flora* (1943) and in McVaugh's earlier paper (1940) the material would have been referred with some reservations to *L. dielsiana.*

We now have from Jalisco one new collection providing ample material of *L. dielsiana,* and it appears that the remainder of our material represents an undescribed species that we are presenting below. The following key is intended to replace that in *North American Flora,* vol. 32A, page 39, under the heading "Corolla-tube not fenestrate laterally. . .":

1. Leaves nearly all basal . . . seeds rough cellular-reticulate. *L. floridana* Chapm.
1. Leaves cauline, or cauline and basal . . . seeds smooth, shining.
   2. All 5 anthers densely tufted at tips. *L. ehrenbergii* Vatke
   2. Two smaller anthers (only) white-tufted at tips.
      3. Capsule much less than half inferior.
         4. Corolla-tube 11–14 mm long; cauline leaves 3–8, 6–9 mm wide, 4–8 times as long as wide; Nuevo León and Tamaulipas. *L. sublibera* S. Wats.
         4. Corolla-tube 6.5–9 mm long; cauline leaves none, or narrower, 0.5–10 mm wide, 8–80 times as long as wide; Jalisco to Oaxaca.

5. Leaves mostly basal; calyx-lobes 4 mm long or less; Guerrero.
L. bryophila var. *fimbriosa* Wimmer

5. Leaves cauline; calyx-lobes (4–)7–10 mm long.
6. Leaves very numerous (often 50 or more below the raceme), almost filiform, 0.5–0.8 mm wide, 3–4 cm long, obscurely denticulate; stems several or many from a woody taproot; raceme not secund, crowded, the flowers (10–)25–50; pedicels ascending, 10–12 mm long; lower lip of corolla 6–8 mm long; upper lobes triangular-tapering, 1.5–1.8 mm wide at base; capsule 6–7 mm long, the hypanthium 1.5 mm long.
L. dielsiana Wimmer

6. Leaves mostly 20 or fewer, linear or broader, the upper ones mostly about 2 mm wide and 6–10 cm long, denticulate, the middle and lower ones up to 1 cm wide, tapering to both ends, with long ascending teeth; stems solitary or few from a rhizomatous base; raceme usually markedly secund, the flowers mostly 15 or fewer, widely separated on the axis; pedicels loosely spreading, 20–35(–40) mm long; lower lip of corolla 8–12 mm long; upper lobes uniformly narrow, or dilated distally, above a short triangular base less than 1.5 mm wide; capsule 9–10 mm long, the hypanthium 2–2.5 mm long.
L. occidentalis McVaugh & Huft

3. Capsule at least half inferior. . . .

1. **Lobelia bryophila** Wimmer var. **fimbriosa** Wimmer, Annal. Naturhist. Mus. Wien 56: 342. 1948.

This, like the two following species, is distinctive in its genus because the developing ovary and the capsule are more than half superior, considerably surpassing in length the short hypanthium. This variety was known to Wimmer from the type only. We have seen the following, all of which were at first mistakenly referred to *Lobelia dielsiana*:

GUERRERO: Petlacala, in pine forest, 1870 m, *Mexia 8967* (F, GH, isotypes); Teotepec, in oak-pine forest, 2360 m, *Hinton 11108* (GH, MICH, US); Petlacala–Buenavista, oak-pine forest, 2275 m, *Hinton 14881* (MICH).–Two of the above collections were made in December and the other in late November.

2. **Lobelia dielsiana** Wimmer, Repert. Sp. Nov. 22: 194. 1926.

We have examined the following collections. The plants from Jalisco match the type-collection precisely, as far as can be determined. Each of the isotypes examined is a short piece taken from the top of a single stem, consisting of a somewhat battered flowering raceme and a few leaves.

GUERRERO: Sierra Madre, 1700 m, 10 Feb. 1899, *Langlassé 852* (GH, US, isotypes). JALISCO: In pine forest 20–22 km S of Talpa de Allende, 1200–1450 m, 28–30 Mar. 1965, *McVaugh 23288* (MICH).

3. **Lobelia occidentalis** McVaugh et Huft, sp. nov. Fig. 1.

Herba 35–70 cm alta, subglabra, foliis supra parce setosis; caules solitarii vel 2–4, interdum ramosi, e basi rhizomata oriundi, plusminusve porcati et angulati, angulis minute scaberulis; folia superiora et bracteae plerumque lineares, 1.5–2(–5) mm latae, (2.5–)4–10 cm longae, remote denticulatae, 8–40-plo longiores quam latiores; folia media latiora, usque ad 1 cm lata, dentibus utroque latere (4–)5–8(–12) ascendentibus parvis vel elongatis usque ad 4 mm longis munita; racemus (6–)10–25 cm longus, laxus, valde secundus, internodiis inferioribus 1.5–3 cm longis, floribus (3–)8–15(–20); bracteae lineares vel superiores angustiores subfiliformes; pedicelli (15–)25–40 mm longi, flexuosi, patentes, ebracteolati, purpurei; calycis tubus

FIG. 1. Flowers and fruit of *Lobelia,* approx. ×2. Above, flower and fruit of *L. occidentalis* McVaugh & Huft (flower from *McVaugh 23097*; fruit from *McVaugh 10313*); lower right, flower of *L. dielsiana* Wimmer (*McVaugh 23288*). (Drawings by Karin Douthit.)

(hypanthium) late obconicus vix 2 mm longus, lobi (4–)6–10 mm longi integri subulati attenuati erecti vel ascendentes; corolla 15–22 mm longa, lavandulacea, labio inferiore basi pubescenti albo-bimaculatoque, vix vel haud declinato, 8–12 mm longo; tubus corollae 7–9 mm longus, partim (1.3–2.3 mm) integer, subcylindricus, latere inferiori porcis duabus elevatis longitudinalibus instructo; corollae lobi superiores elongati, in annuli formam valde recurvati; filamenta glabra 4–5 mm longa; antherarum tubus ca 2 mm longus, antheris 3 superioribus pilosulis, 2 inferioribus apice setoso-penicillatis; ovarium per et post anthesin subsuperius, capsulae maturae parte superiore 7–9 mm longa, 2.5–3 mm lata, ellipsoidea; hypanthium maturitate 2–2.5 mm longum; semina 0.7 mm longa ellipsoidea lucida, minutissime lineata.

The upper leaves are usually linear, resembling the lower bracts and passing insensibly into them, scarcely narrowed at base, but long-tapering to the attenuate apex. The middle leaves in most plants are much wider and often shorter, cuneately tapering to both ends, usually with several pairs of slender teeth from the middle to the tip. The lower leaves are mostly wanting at flowering time.

Specimens examined: JALISCO: Sierra de Manantlán, SE of Autlán, between El Chante and Cuzalapa, on steep shaded banks in pine-oak forests, 1500–2700 m, flowering from mid-March to late April, *McVaugh 10313* (MICH), *10249* (MICH, holotype; GH), *23097* (MICH), *23207* (MICH). GUERRERO: Mpio. Tlacotepec, Aserradero Agua Fría, cerca del cerro Tlacotepec, bosque de *Pinus, Quercus* y *Abies,* 2600 m, 10 Abr. 1963, *Rzedowski 16474* (MICH).

The long corolla tube without any tendency to become fenestrate, much longer than the filaments, and divided no more than 2/3 or 3/4 its length by the dorsal fissure, is characteristic of *Lobelia occidentalis, L. bryophila,* and *L. dielsiana.* These species evidently form a rather close-knit group, united further by the characters of ebracteolate pedicels and the essentially superior ovary that distends the marcescent corolla as it grows. All three species are plants of pine or pine-oak forests of the mountains of the Pacific slope of Mexico, from Jalisco to Oaxaca. A fourth species, *L. pulchella,* probably originally from Hidalgo, is of the same affinity.

For loans of herbarium material, and for other courtesies, we are much indebted to the authorities at the Field Museum (Chicago), the Gray Herbarium (Harvard University, Cambridge, Mass.), and the United States National Herbarium (Washington).

Contr. Univ. Mich. Herb. 11(2):69–71. 1975.

ANTIPHYTUM PARRYI (BORAGINACEAE) CONFUSED WITH HELIOTROPIUM LIMBATUM

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A common and conspicuous boraginaceous plant of west-central Mexico is *Heliotropium limbatum* Benth. (Pl. Hartw. 20. 1839), which ranges from Sonora to Aguascalientes and Jalisco, the State of Mexico, Puebla, and Oaxaca. It is apparently most abundant on the western side of the Mexican plateau. It is a prostrate or procumbent rosette-forming woody-based herb or sub-shrub, with showy white flowers. Some recent collections, at first referred to *H. limbatum* because of similarities in habit and aspect, proved to represent quite a different plant. Investigation in several herbaria showed that the two species had been confused in several instances in the past, always under the name of *H. limbatum,* the more common and widely distributed of the two. The second species proved upon close examination to be *Antiphytum parryi* S. Wats. (Proc. Am. Acad. 18: 122. 1883), heretofore little known except from the type but evidently much more common, at least in the eastern part of the Mexican plateau, than previously supposed.

In fact, the two species are not very similar in floral details and are not easily confused except upon the most superficial examination. According to the prevailing concepts of the classification of the Boraginaceae, they belong to different tribes. In the *Heliotropieae* the ovary is merely lobed, with a terminal style; in the *Borageineae* the style arises from the midst of four nearly distinct nutlets. In the two species considered here, *Heloptropium limbatum* has smooth or nearly smooth nutlets, the style arises essentially from the nearly approximate summits of the nutlets, and it stands well above the fruit as a whole; the stigma is annular-peltate and is surmounted by a conical terminal appendage. In *Antiphytum parryi* the nutlets are well separated and conspicuously pebbled on the outer sides; the style arises from a conical gynobase below the center of the nutlets and is shorter than or barely as long as the nutlets; and the stigma is small, terminal, and inconspicuously bifid.

The genus *Antiphytum* was reviewed by Ivan M. Johnston (Contr. Gray Herb. II. 68: 48–52. 1923) at a time when only three specimens of *A. parryi* were available to him (*viz.* the type, an over-mature fruiting specimen from somewhere north of San Luis Potosí; a specimen from an unknown locality, collected by Coulter; and a flowering specimen, *L. C. Smith 394,* from Sosola, Oaxaca). Johnston expressed some doubt that the type and the Oaxaca specimen were conspecific but finally associated then "because of the remarkable similarity in the size and developments" of all observable characters.

On the basis of new material it can now be reported confidently that *Antiphytum parryi* ranges northward and northwestward from the Valley of Oaxaca through Puebla, Hidalgo, and Querétaro to San Luis Potosí, apparently favoring somewhat drier and more calcareous habitats than *Heliotropium limbatum* and found mostly to the east of the principal distribution of that species.

The range of *A. parryi,* as shown by the specimens now in hand, is as follows (see also Fig. 2):

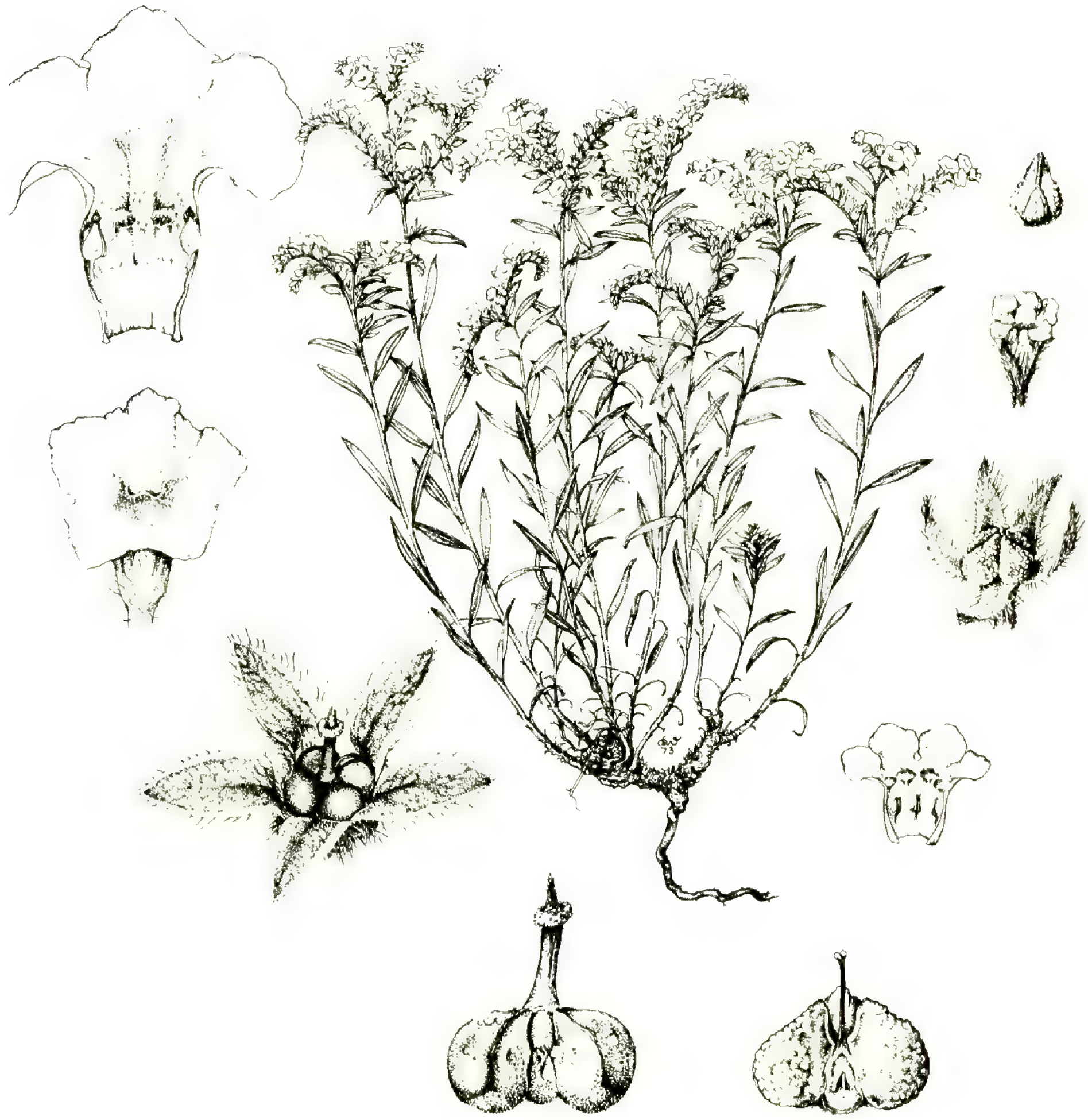

FIG. 1. Habit of *Heliotropium limbatum*, ×½. Floral details of *H. limbatum*, at left, top to bottom: Interior of corolla, ×5; corolla-limb, ×3.5; nutlets in calyx, ×5; nutlets with one removed to show attachment, ×10. Floral details of *Antiphytum parryi*, at right, top to bottom (all from *Cruz Cisneros 1978*): Adaxial face of nutlet, ×5; corolla-limb, ×3.5; nutlets in calyx, ×5; interior of corolla, ×5; nutlets with one removed to show attachment, ×10. (All drawings by Karin Douthit.)

MEXICO: SAN LUIS POTOSI: Charcas, 6 VII 1934, *Lundell 5114* (GH, MICH); "En route from San Luis Potosí to San Antonio, Texas," VIII 1878, *Parry 618* (GH, type). GUANAJUATO: Puerto Nieto, 13 VIII 1947, *Kenoyer 2048* (GH); San Miguel Allende, 2100 m, 1 XI 1973, *Rzedowski 31508* (ENCB, MICH). QUERETARO: 11 miles NE of San Juan del Río, on limestone plain, 16 VIII 1957, *Waterfall 13931* (A). HIDALGO: Tula, 3–4 VII 1905, *Rose 8351* (US); El Salto, 16 IX 1903, *Rose 7082* (US). PUEBLA: Chapulco, XII 1841, *Liebmann 12768* (US). OAXACA: 1.5 km N of Magdalena Jicotlán, ladera calichosa, 22 VII 1968, *Cruz Cisneros 1978* (MICH); Sosola, 7000 ft., 3 VII 1895, *L.C. Smith 394* (GH); San Antonio Ocotlán, 6 VIII 1971, *Messer 208a* (MICH).

Heliotropium limbatum and *Antiphytum parryi* probably do not occur together in nature. The former is known to us from a single locality in Oaxaca (Cerro San Felipe, above San Felipe de Agua, 1700–2000 m, in oak forest, *Anderson & Anderson 4870*, MICH) and from a single locality in Puebla (21 km from Puebla on the Atlixco

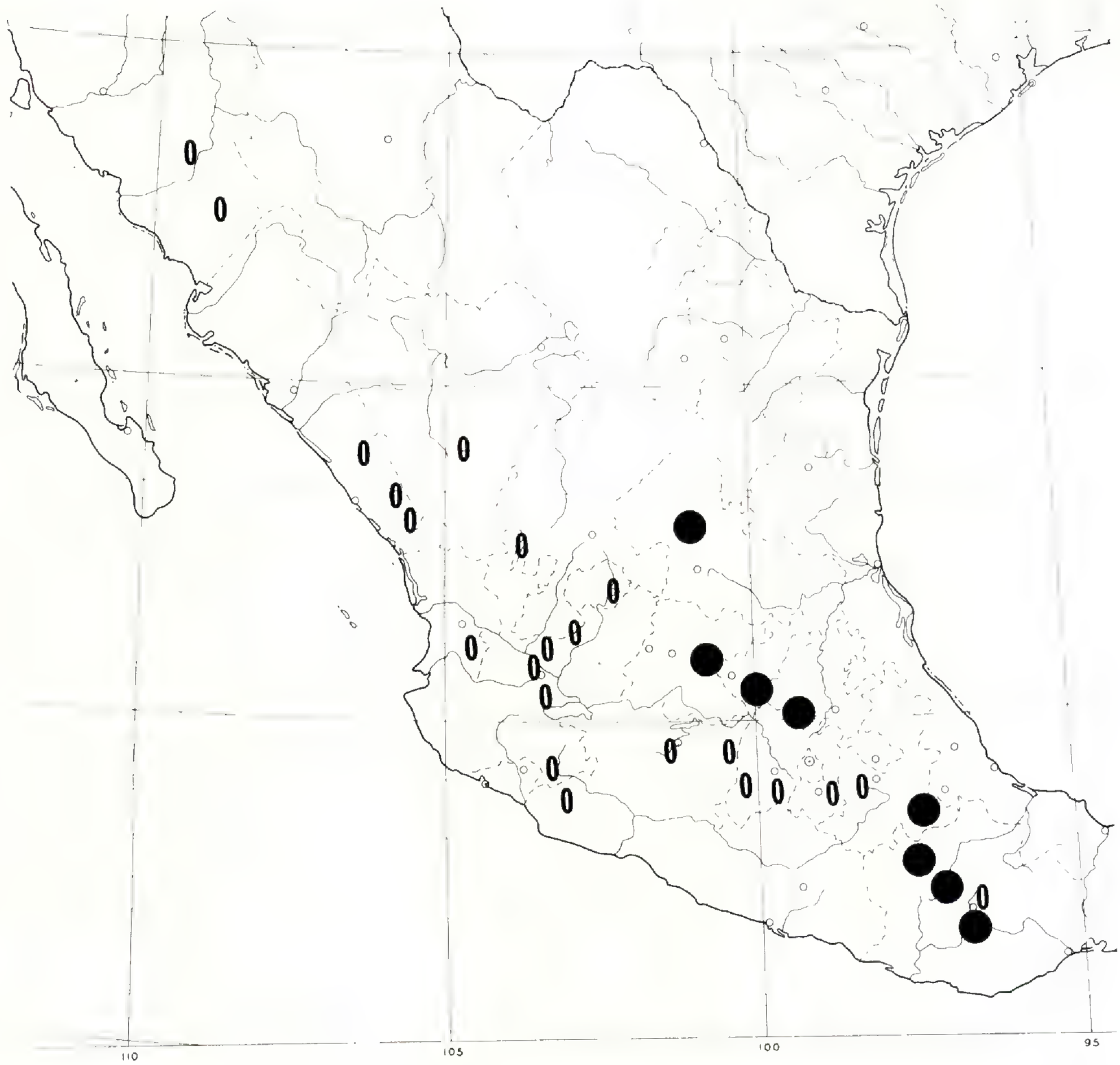

FIG. 2. Known distribution of *Heliotropium limbatum* (open ellipses) and *Antiphytum parryi* (solid circles).

road, *Schnooberger 8699, 8706,* MICH). We have not seen any other specimens of *H. limbatum* from east of Aguascalientes and Morelos (see Fig. 2).

For the loan of specimens, including the type of *Antiphytum parryi,* we are much indebted to Dr. L. I. Nevling, Jr., of the Harvard University Herbaria, and Mr. James White, of the U.S. National Museum.

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A PELAGIC SARGASSUM FROM THE WESTERN ATLANTIC[1]

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In the course of an exhaustive study of the animal associates of the pelagic *Sargassa* of the Sargasso Sea, Gulf Stream and West Indies, Mr. Byron F. Morris of the Bermuda Biological Station has at various times found, intermixed, parts of drifting plants which had a littoral origin, but in addition has found a very tiny species which he recognized as peculiar and called to my attention a couple of years ago. Mr. Morris has most kindly turned the material over to me for study and report. This plant occurs very sparingly in the netted hauls of *Sargassa,* but over the period since first noticed many individual specimens have accumulated. As the method of collecting by a net towed from a vessel in a series of hauls favored pooling of several net loads from a general area, no specific spot in the ocean can be designated as the type locality. The early series of hauls derived from the waters off the east side of Bermuda, but a recent lot came from more southerly waters, east and south from Puerto Rico.

Sargassum is a hazardous genus in which to offer new taxa, for very many often variable species have been described, and for many of these a surplus of varieties and forms. Grunow studied the genus exhaustively, and his monograph, in which a vast number of entities are listed, was published (1915, 1916) after his death. I find nothing there corresponding to the plants here reported, and they do not find a place in my general account of the Western Atlantic warm water algae (1960), though they had been seen and cursorily reported by Winge (1923, p. 24, fig. 8). On the authority of Yendo, Winge tentatively ascribed these plants to *S. myriocystum* J. Ag., a substantially different plant of the Indian and western Pacific Oceans, but that is an allocation which I cannot accept. There is a slight resemblance to *S. polycystum* C. Ag., in the form secured from Banka near Sumatra by G. v. Martens, referred by Grunow to f. *festiva* (Grunow 1915 p. 444), but that plant is reported to be far larger, and is looser in habit, with abundant foliage in the specimen available for comparison.

Sargassum pusillum sp. nov. Figs. 1, 2.

Plantae minimae, conferte fruticosae, 2–3-plo alterne ramosae, totis ramis dense muriculatis. Vesiculae sphericae, abundantes, ca. 2 mm diam., plerumque stipitatae. Folia rara, cum optime evoluta lanceolata, costam male effectam atque nonnulla cryptostomata habentia. Speciminia typica pelagica, apud algas fluitantes prope oram Atlanticam insularum Antilles inter insulas Antigua atque Puerto Rico dictas reperta, a Byron Morris, d. 24–27, m. Jan. 1974 collecta, in herbario Universitatis Michiganensis conservata.

Plants densely bushy, to 3–4 cm. tall and broad, 2–5 times alternately branched, without any notable leading axis. Branches of all degrees densely muriculate, the spines often forked, 0.2–2.0 mm long. Vesicles abundant, nearly spherical at maturity, to

[1]Contribution no. 615 from the Bermuda Biological Station.

FIG. 1. Two portions of a plant from the type material of *Sargassum pusillum*, showing the muriculate stems and the abundant vesicles, ×2.3.

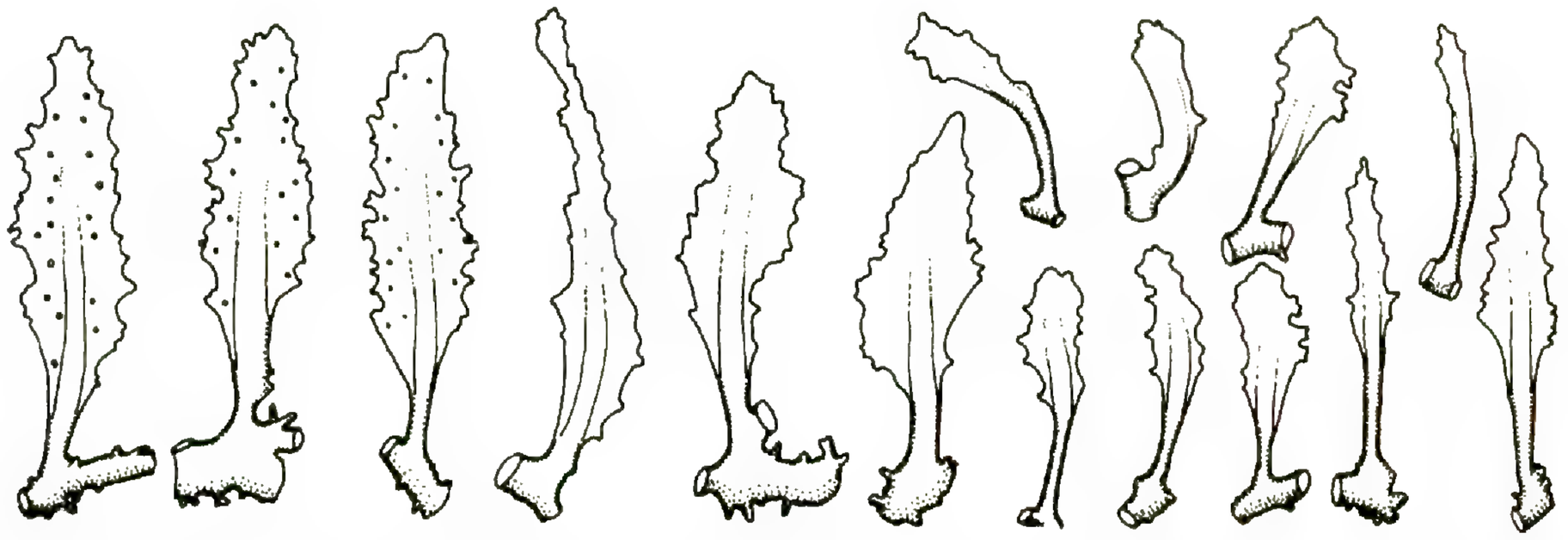

FIG. 2. Leaves from plants of the type material of *Sargassum pusillum*, to show gradation from the best-developed examples to those with minimal lamina, ×4.

1.5–3.0, usually about 2.0 mm diam., occasionally with a minute apiculus, subsessile or more often on stalks which are longer than the young vesicles but shorter than the largest ones. Leaves rare, fleshy, compressed-linear, and then entire, to lanceolate, the tips obtuse to attenuate, and on these wider blades the midribs obscure except near the short leaf stalk, the margins irregularly dentate, and the cryptostomata inconspicuous when present, 100–130 μm diam. Receptacular branches not seen.

TYPE pelagic, found among floating algae off the Atlantic side of the Antilles between Antigua and Puerto Rico, collected by Byron F. Morris, 24–27 Jan. 1974, and conserved in the herbarium of the University of Michigan. Other material, also collected by Mr. Morris, was secured from his Station S, 18 miles (approx. 29 km.) SE of Bermuda at 32°10′ N.L., 64°30′ W.L., throughout 1973 and 1974.

It seems best to describe these small plants as a new species. Winge, as mentioned, saw them, but he related them to a species of improbable provenance, whereas he illustrated (his fig. 9) a plant which might be referred to *S. fluitans* Børg.,

for that species is often somewhat muriculate, though Winge's drawing is exceptionally so, and the leaves as shown unusually narrow for that species. The little plants in question have the muriculate character highly developed, far more than in his fig. 9 or any typical *S. fluitans*; they have very little foliage, but the leaves have the cryptostomata few and very small as in *S. fluitans.* Since no plants at all intermediate were seen in Mr. Morris' collections, it seems best not to assume a relationship with *S. fluitans.* As to the other plankton species, *S. natans* (L.) J. Mayen, it is not known to be at all muriculate, the leaves lack cryptostomata and differ in the form of the marginal teeth, and the vesicles are, commonly at least, apiculate, even to having a long, subfoliar appendage.

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Contr. Univ. Mich. Herb. 11(2):77–79. 1975.

A NOTEWORTHY VARIANT CAULERPA

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In the course of my study of western Pacific Caulerpas I have recently come across a flat-ramellar species which I do not find described in the literature. The individual ramelli relate this at once to *C. mexicana* (Sond.) J. Ag. (Taylor 1960, p. 141, pl. 12 fig. 5), but the habit at a quick glance is indeed very different, and dried specimens suggest a form of *C. racemosa* var. *laetevirens* (Mont.) Weber-van Bosse, such as Mme. Weber-van Bosse illustrated (1898, pl. 33, fig. 16a), until close examination and sectioning demonstrate that the ramelli are apiculate and structurally flat. Børgesen (1952, p. 9) mentioned occasional misplaced, rather deformed ramelli on dwarf plants of this species in Mauritius, but in the plants here considered the ramelli are normally pluriseriate and normally shaped. Often as I have seen the species in the Caribbean area, I have not found the pluriseriate variant there.

Varietal transitions between pluriseriate and bilateral distribution of ramelli are well known in the genus, and this feature is not of itself worthy of distinction at the species level, but at the varietal level it is recognized. Among others, excellent examples occur in *C. sertularioides* (Gmel.) Howe and in *C. racemosa* (Forssk.) J. Ag.

It is curious that this variety should first have appeared in both of the collections which I have recently been studying (Taylor, in press). In one, from near Yap Harbor, the flat ramelli were densely crowded on the axes and so pluriseriate to an advanced degree. The other, from the Philippines, was in general less dense, though seldom with but three rows, often more, and then irregularly placed. The ramelli in the Yap specimens are somewhat narrower than those in the other. Rather more distinctively developed, though small, were specimens from Pulau Tatagan off North Borneo in Malaysia, and from these I have selected the illustration. A somewhat similar variation appears in a specimen of *C. taxifolia* (Vohl) C. Agardh from El-Tur, eastern Sinai, collected by Y. Lipkin, SLRRA no. 359, 20 ix 67, but the variation affects only some of the branches, not all. For this one should accept the name *falcifolia* on a varietal level as **Caulerpa taxifolia** var. **falcifolia** (Harv. & Bail.) n. comb. (*C. falcifolia* Harv. & Bail. 1851 p. 373; Bail. & Harv. 1862-74, vol. 17, p. 171, Pl. 8, figs. 4, 5). Mme Weber-van Bosse (1898, p. 293) associated Harvey and Bailey's plant more closely with *C. taxifolia* than with her concept of *C. mexicana* (Sond.) J. Ag. [as *C. pinnata* f. *mexicana* (Sond.) Kütz.].

Caulerpa mexicana (Sond.) J. Ag. var. **pluristeriata** n. var. Fig. 1.

Plantae habitu speciei typicae similes, minores, axes erecti usque ad ca. 5 cm alt., subsimplices; ramelli raro distichi, sed in tribus ordinibus vel pluribus ordinata, distributione irregulares facti, plani, in basi manifeste contracti, aliquantulo latiores in parte superiore quam inferne; cacumina rotundata, apiculata, magnitudine usque ad 2.8–3.6 mm long., 1.4–2.0 mm lat., angustiora, autem, in axibus confertioribus. Specimen typicum in loco dicto Malaysia, Tatagan Island, a C. F. Cleland lecto, 4 ii 65, in herbario Universitatis Michiganensis conservatum.

FIG. 1. Type specimen of *Caulerpa mexicana* n. var. *pluriseriata* from Tatagon, Malaysia, ×3.5.

Plants in habit similar to the type, smaller, the erect axes to about 5 cm tall, subsimple, the ramelli rarely distichous, but in 3 rows or more, becoming irregular in distribution, flat, distinctly contracted at the base, somewhat wider in the upper part than below, the tips rounded, apiculate, in size to 2.8–3.6 mm long, 1.4–2.0 mm broad, but narrower on the more crowded axes.

PHILIPPINE ISLANDS, Luzon I., Pangasinan Prov., Lingayan Gulf, Cabarruyan I., from the reef area east of Macalieng Point, *G. A. Santos 20431,* 26 iii 68, *in herb.* M. S. Doty. Negros Oriental Prov., Siquijor I., Tungo, *A. Y. Reyes 72156,* 25 v 72, *in herb.* W. R. Taylor. CAROLINE ISLANDS, Yap Island group, Yap, south of the channel near Yap Harbor, from the reef on a sandy substratum with rocks and patches of "eel grass," *E. G. Meñez 23776,* 19 viii 60, *in herb.* M. S. Doty. MALAYSIA, Pulau Gaya area, Station 9, Pulau Tatagan, in a rocky area near the village, *C. F. Cleland,* 4 ii 65, *in herb.* Univ. Mich. (TYPE).

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Contr. Univ. Mich. Herb. 11(2):81–83. 1975.

A NEW SPECIES OF HALIMEDA FROM MALAYSIA

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A large number of marine algae collected by Dr. Charles F. Cleland on an expedition sponsored by Stanford University in 1965 has been most generously placed in my hands for study. An extensive list of the species found will be published elsewhere (Taylor, in press). A handsome *Halimeda* (Chlorophyceae, Siphonales, Codiaceae) particularly attracted my attention.

At first glance it looked as if this *Halimeda* should be considered a variant of *H. micronesica* Yamada (1944, p. 24). As soon as microscopic examination of frontal sections was made, and it was found that the decalcified surface utricles could not be separated under pressure even in the youngest segments, it was clear that a full structural analysis would have to be made, and it was realized that the presence of a flabellar primary segment at the base of the plant, which might be very broad (Fig. 1), was about the only feature held in common with *H. micronesica.* This feature may be much obscured in compact, dwarfed individuals. In surface aspect the lower branching of the plant is of broad, flat segments from the start, not of narrower, simply compressed segments as is characteristic of *H. micronesica.* The cortical utricles are not only clearly, if narrowly, joined together laterally (Fig. 2b), but are sharply obconical or turbinate rather than pyriform-distended from the narrow juncture with the subcortical. They are 22-42 μm in diameter in surface view. The medullary filaments are interconnected (Fig. 2a) at the nodes, but so very lightly that they generally separate as if free on dissection, only scars showing the pores by which they communicate. In this they differ from another species, *H. simulans* Howe of Caribbean waters, which is somewhat similar in aspect, for there these filaments are firmly joined. In *H. simulans* the lower segments are more generally stalk-like, the cortical utricles more deeply joined laterally, and the subcortical utricles more swollen.

With these points in mind I re-examined material from the Society and Santa Cruz Islands which had previously been reported as *H. simulans.* Much of it appeared to be from exposed situations and so was very compact, and the base distorted, but the nodal and cortical characters agreed with the Malaysian rather than the West Indian plants. It seemed to me best to consider these Pacific plants distinct from *H. simulans,* recognizing some similarities to that species and some to *H. micronesica,* but finding them *in toto* distinct from both. Another plant which might be considered in relation to this one is *H. batanensis* Taylor (1973, p. 34). However, that is a smaller species overall, and in its segment size. The basal segment is not a broad disk. The upper segments in it are proportionately thicker and are not crenate, though occasionally trilobed. The surface utricles are much smaller in *H. batanensis* than in *H. borneensis,* and the nodal fusions, clearly in pairs, are more complete.

Halimeda borneensis n. sp. Figs. 1, 2.

Plantae satis parvae, fruticosae, usque ad 6–7 cm alt., basi infossa stuposa, segmento foliari primario plano, anguste lateve flabelliformi, aliquot ramos planos

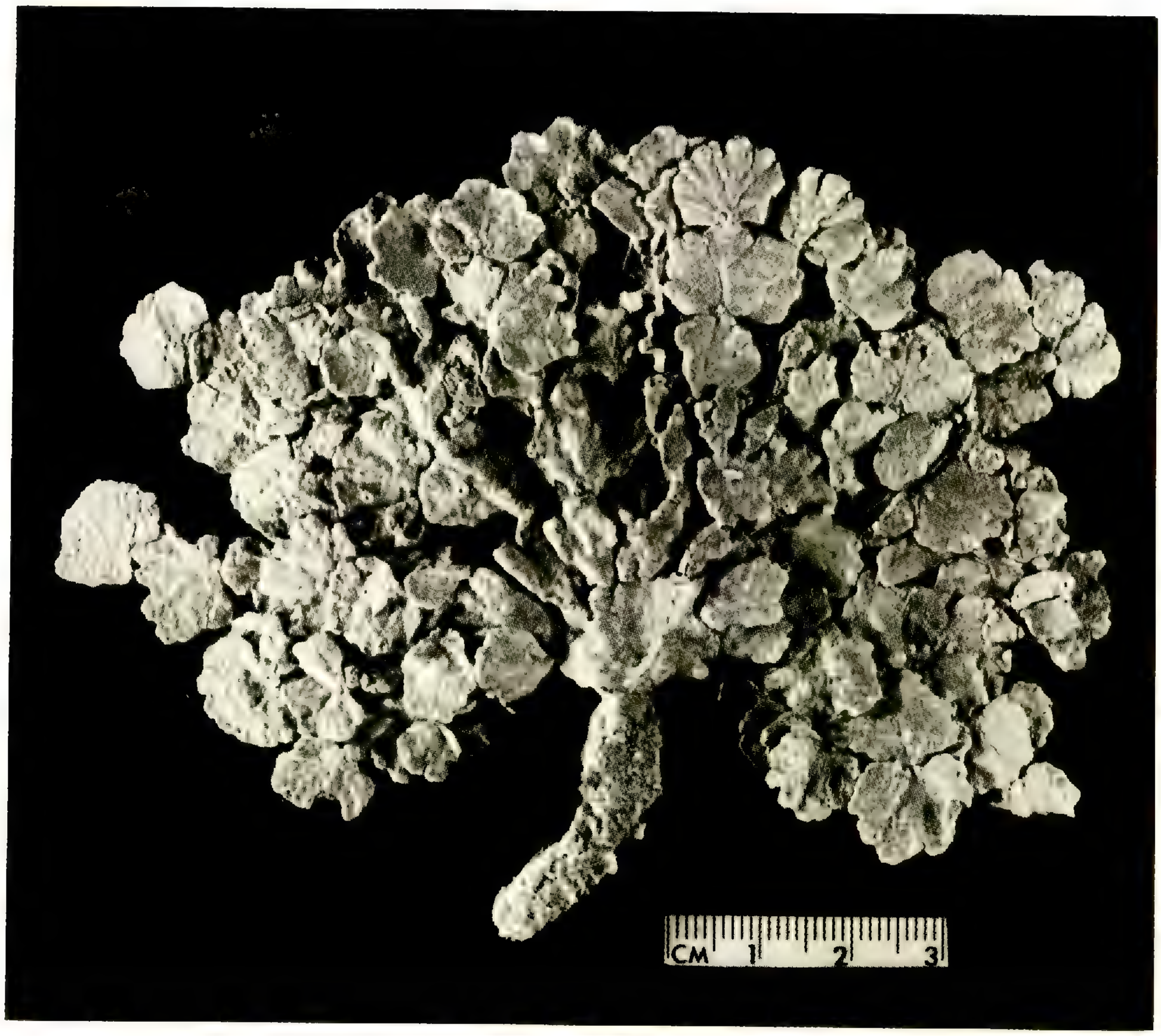

FIG. 1. *Halimeda borneensis*: habit of type specimen.

segmentatos ferente. Segmenta ramorum ovata ad reniformia, saepe distaliter crenata, usque ad 10–12 mm diam. Utriculi corticales a superficie visi angulares, lateraliter firme coniuncti, 22–24 μm diam., in sectione transversa turbinati, ad superficiem angustissime coniuncti. Filamenta medullatia ad nodos coalita, per locos contactos partim inter se communicata, facile, autem seiungentia. Specimen typicum in insula Pulau Gaya dicta, prope oram orientalem Bornei borealis, a Charles F. Cleland, statione Nr. 10, m. Feb. 1965, collectum; in Herbario Universitatis Michiganensis depositum.

Plants rather small, to 6–7 cm tall, spreading to a width of 12 cm, densely bushy, the stupose buried base a firm, subcylindrical mass of rhizoids and sand to 1 cm diam., 3 cm long. Above this a single flabellar basal segment at times small, but in larger plants to 2 cm broad, 12 mm long, bears few to several (at least to 8) branching series of well-calcified segments. The habit of these branches tends to be plane, the segments composing them to 10–17 mm broad, 10–12 mm long, ovate to reniform, the base often a little contracted, the distal margin entire to frequently slightly 3–7-crenate. The segment surface in young parts is slightly nitent, in older parts dull and very obscurely ridged toward any distal crenations. The cortex in surface view shows the utricles as angular, 22–42 μm diam., closely adherent, not separable by pressure after decalcification. In section these cortical utricles appear obconical, about 1.5 times as long as broad, laterally attached at the surface by a very narrow margin.

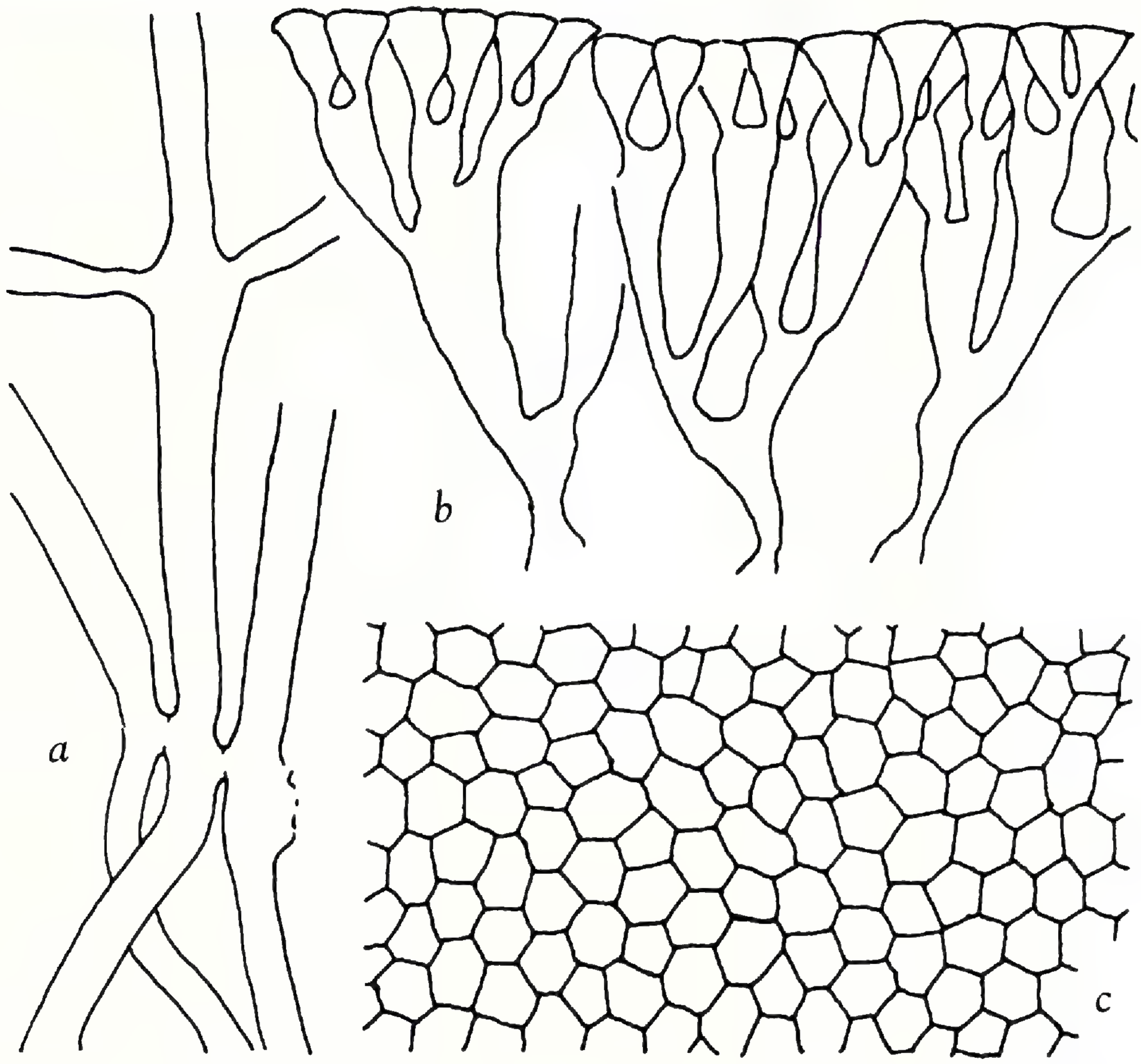

FIG. 2. *Halimeda borneensis*: *a*. Nodal filaments carefully dissected from the general nodal group to show the connections, ×105. *b*. Cortical and subcortical utricles in transverse section, ×210. *c*. Cortical utricles in surface view, ×210.

The subcortical utricles are usually about 1.5–3.0 times as long as those of the cortex, but hardly broader, though in some regions they become considerably longer. The medullary filaments are slightly thickened and a very little browned at the older nodes, lightly united into a single mass, readily broken up by dissection. The filaments in the mass communicate by pores of various sizes. Above the fusion mass the filaments continue undivided for a considerable distance. Gametangia were not seen.

TYPE: Pulau Gaya off the east coast of North Borneo, *Charles F. Cleland*, Station 10, 5 Feb. 1965, *in herb.* MICH.

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NOTES ON THE DISTRIBUTION OF SPHAGNUM TENELLUM

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The *Sphagnum* flora of Mexico consists of a meager few species represented in herbaria and in the literature by scattered records. The recent discovery of *S. tenellum* Ehrh. *ex* Hoffm. in the mountains of Oaxaca, in eastern Mexico, provides a species additional to the known flora of the country and a remarkable range extension.

Sphagnum tenellum is clearly related to *S. recurvum* P.-Beauv. and its allies. Its distinctive appearance and structure are illustrated by the accompanying plate. The plants, small and delicate, grow in loose, pale, green, yellowish, or brownish carpets, soft and fluffy when dry. The well-spaced, broad leaves are more or less flattened out (rather than involute-concave) when dry, but unlike those of many members of the section Cuspidata not wavy at the margins. The stem and branch leaves are similar in shape and structure, and the retort cells of the branch cortex are remarkably long-necked. In less typical expressions, the plant may be a darker shade of brown and more compactly tufted, with leaves of young branches more crowded and appressed, in which case the short, stout, blunt branches of the capitulum are noticeably curved upward. Such forms probably occur in relatively dry sites. It appears that sporophytes are quite commonly produced in Europe and North America; mature spores were seen in numerous collections spaced from May 12 to August 18.

Sphagnum tenellum is an "Atlantic" species, favoring the moist, cool climates of northern coastlands but also occurring in a few inland and montane localities. It flourishes in areas of oceanic climates in open, wet places but not in the standing water of shallow pools, on a firm, peaty substrate, in raised and blanket bogs, around the margins of pools or in depressions among hummocks, less commonly in the seepage of springs. It characterizes well-established ombrotrophic peatlands, poor in minerals and distinctly acid in reaction, but its occurrence in hollows suggests that it belongs at the lower end of a base-to-acid gradient, however slight that may be. It is commonly associated in such peatlands with *Cladopodiella fluitans* and *Sphagnum lindbergii, S. pulchrum, S. balticum, S. pylaisii, S. molle, S. subnitens, S. compactum,* and *S. papillosum.*

Farther north, in Greenland, for example (Holmen, 1965), where peat accumulation is minimal, it occurs in areas of prolonged snow cover, often in seepage from the edges of snow patches. In the mountains, *S. tenellum* grows in open places at relatively high altitudes, on boggy slopes and in seepage on humus-covered, acid rocks, at the edges of rock slides (in New York), at the margins of shrub mats overlying ledges (in the heath balds of North Carolina), and on ledges of cliffs on boggy alpine slopes (in British Columbia).

The North American distribution has been documented in two informative papers by Maass, both published in 1966. The species grows along the coasts and also in treeless alpine situations in southeastern Alaska and British Columbia (up to heights of 5500 ft. on Vancouver Island.) In the East, it occurs in coastal habitats in a discontinuous pattern from southernmost Greenland to Long Island, New York, and the pine barrens of New Jersey; in a few inland stations in Labrador, northern and

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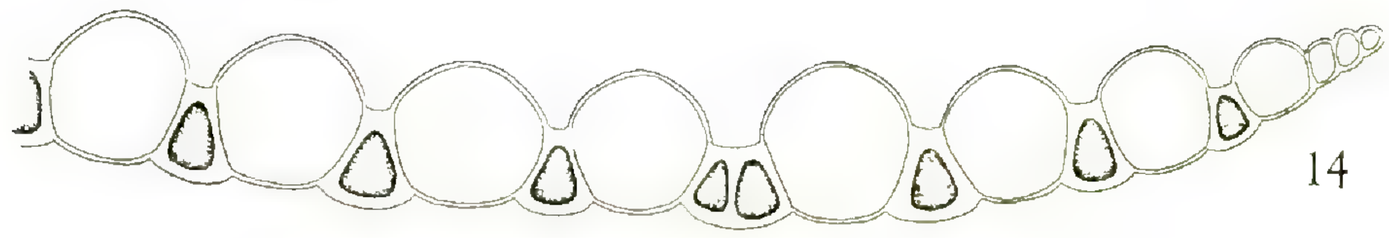
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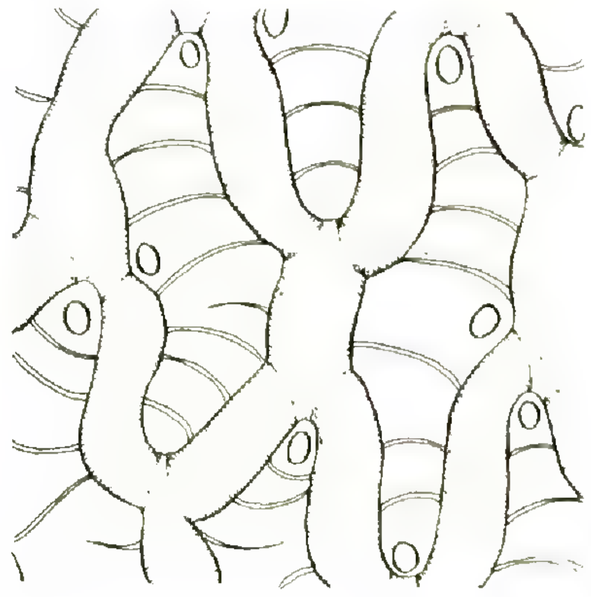
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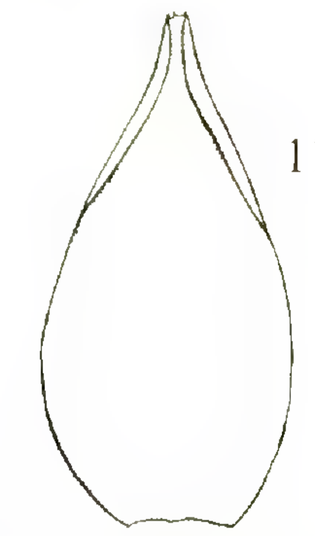
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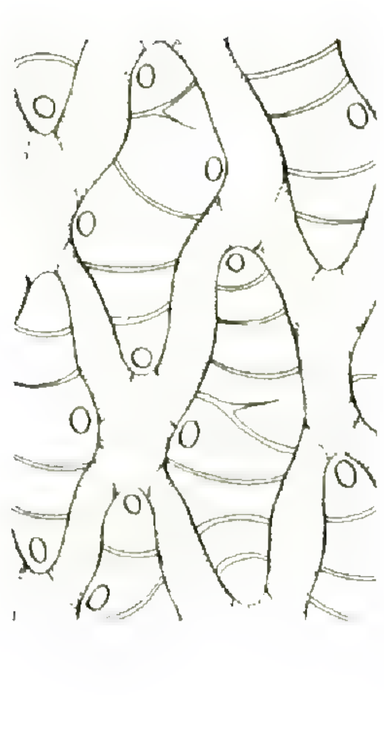
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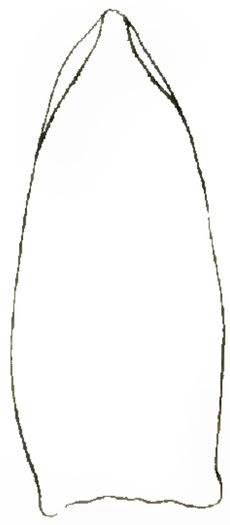
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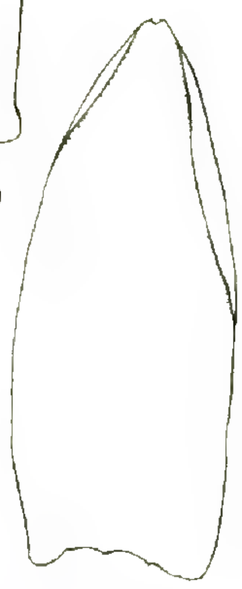

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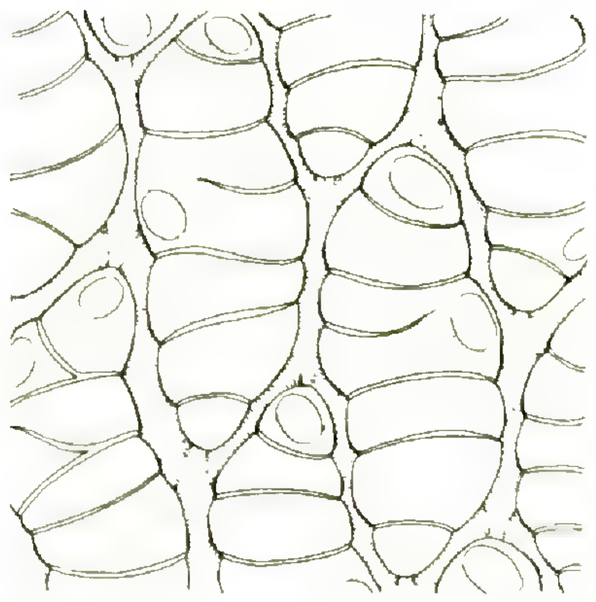
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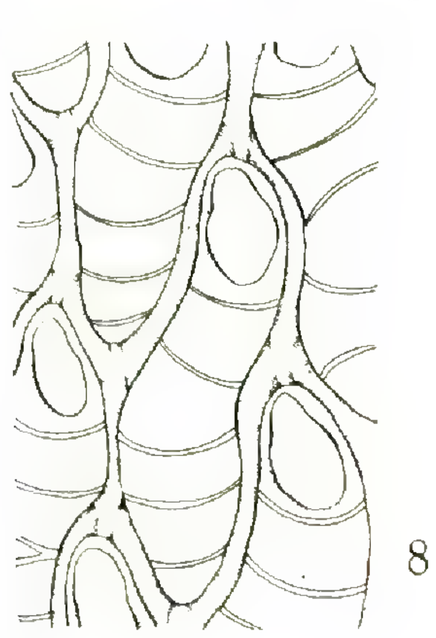
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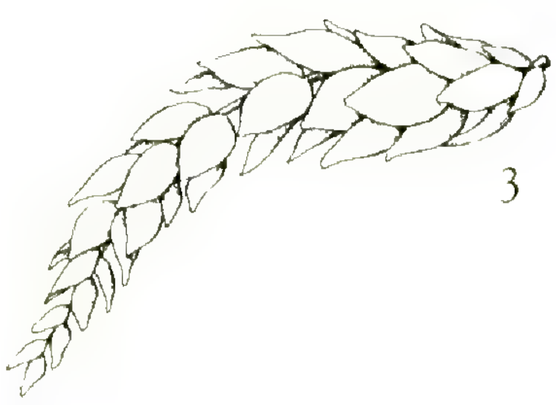
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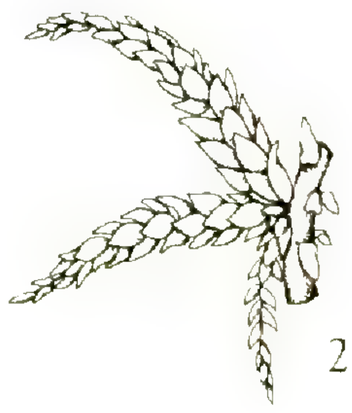
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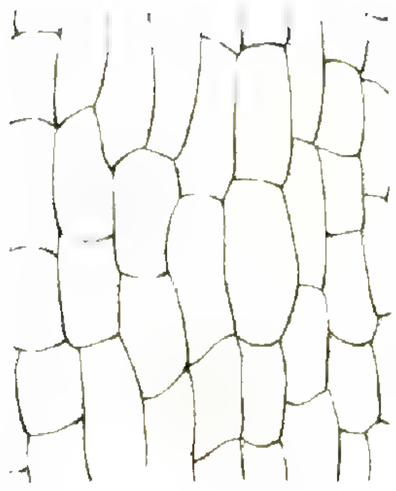
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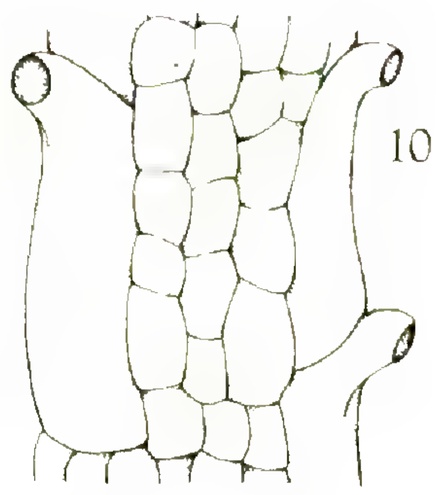
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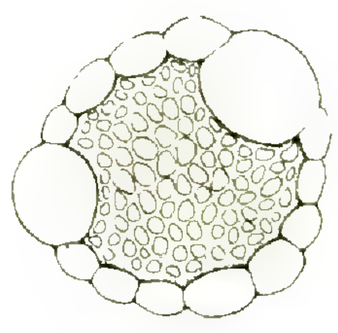
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Sphagnum tenellum. 1. Habit, dry, ×1. 2. Fascicle, dry, ×3. 3. Single branch, dry, ×7. 4. Cross-section of stem, ×118. 5. Cortical cells of stem, surface view, ×118. 6. Stem leaves, ×27. 7. Cells of upper portion of stem leaf, outer surface, ×400. 8. Cells of upper portion of stem leaf, inner surface, ×400. 9. Cross-section of branch, ×118. 10. Branch cortex, ×118. 11. Branch leaves, ×27. 12. Cells of upper portion of branch leaf, outer surface, ×400. 13. Cells of upper portion of branch leaf, inner surface, ×400. 14. Cross-section of branch leaf, ×400. (Prepared by Constance Butley).

central Quebec, and northern Ontario; and in montane areas of New York (up to about 5100 ft.) and North Carolina (at 4400 ft.). In Japan it grows at sea level and also as high as 1890 meters elevation. In Europe it occurs in montane localities in France, Germany, Austria, Poland and Czechoslovakia, at least.

Andrews (1938), an unusually reliable source of information on *Sphagnum,* reported *S. tenellum* from Wisconsin and West Virginia but admitted that in both these localities the plants were "decidedly atypical and barely holding their own against uncongenial conditions." However, Maass (1966) reported that all previous reports from Washington, Ohio, and Rhode Island, were based on misidentifications. No doubt some confusion between *S. tenellum* Ehrh. *ex* Hoffm. and *S. capillaceum* var. *tenellum* (Schimp.) Andr. has contributed to a faulty record. Without making a really exhaustive herbarium search, I have been able to confirm in essence the range which Maass presented: I have seen specimens from Newfoundland, Miquelon, Labrador, Nova Scotia, New Brunswick, Prince Edward Island, Quebec (Anticosti), Maine, New York, New Jersey, and North Carolina in the East and from southeastern Alaska and several localities in coastal British Columbia in the West. I have also seen material from northern and central Europe (including also Wales, England, Ireland, and Scotland) and Japan. Records from Alberta, Saskatchewan, and Manitoba reported in the literature (summarized by Bird, 1973) seem doubtful in view of the essentially oceanic nature of the species, both in distribution and habitat preference. I have been unable to locate substantiating specimens, in any case.

Maass reported *S. tenellum* from the Serra dos Orgãos in southeastern Brazil and confirmed Andrews' record (1950) from the Andes of Ecuador (at an altitude of 2700 meters in the province of Loja). It is now possible to record the species from a locality intermediate between the populations of North and South America, and a remarkable range extension from both. Several collections were made recently in Mexico, in the state of Oaxaca, all preserved in the herbarium of the University of Tennessee and sent to me by A. J. Sharp: On the wet bank of a spring (with *Breutelia* and *Rhacocarpus*), *ca* 9500 ft. alt., Sierra Juárez gap, north of Oaxaca, *Evelyn Sharp et al.*,; in seepage, 6200 ft. alt., and on a slope by a spring, 9780 ft. alt., Sierra Juárez gap, *H. J. Webster et al.*; on the wet bank of a stream, 9000 ft. alt., Llano de las Flores, *A. J. Sharp.*

The fact that this species, so rare and interesting an element in the mountains of North Carolina, occurs also in the mountains of eastern Mexico makes it seem likely that it will also appear, with other mosses of similar disjunction, in the montane floras of Guatemala and Costa Rica.

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COMMENTS ON SPHAGNUM CAPILLACEUM

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It is difficult to believe that one of the most common peatmosses of North America and Eurasia has been in nomenclatural confusion for more than two centuries. After 200 years of discussion and debate, bibliographic and legalistic, a solution seems possible, and an easy one, at that. The species in question is generally known in North America as *Sphagnum capillaceum* (Weiss) Schrank, but in Europe, and recently on this side of the water too, the name *S. nemoreum* Scop. has received considerable favor; *Sphagnum capillifolium* (Ehrh.) Hedw. and *S. acutifolium* Ehrh. *ex* Schrad. are in less common use. All these names originated in the 1700's–*S. nemoreum* dates back to 1772, *S. capillifolium* to 1782, *S. capillaceum* to 1789, and *S. acutifolium* to 1794. The last three can be traced back even further, to Dillenius and Linnaeus, by references to synonymy at a lower rank.

The oldest name at the level of species is undeniably *S. nemoreum,* but its application is by no means certain. The meaning of the others is made patent by references in their protologues. In fact, the specimen in Dillenius' herbarium already designated as the type of *S. capillaceum* (Taylor, 1953) could serve as the lectotype for all three. Therefore, only *S. nemoreum* remains in need of definition and typification. Andrews (1959) conceded that the name *S. nemoreum* Scop. is older than *S. capillaceum* or *S. acutifolium* but pointed out that its "description is not adequate for identification, and as far I am aware no material of it has been preserved. Evidence as to its identity adduced by S. O. Lindberg and K. F. Dusén is highly circumstantial and unconvincing. . . . On the other hand the name *capillaceum* rests at least in part on specimens preserved in the Dillenian herbarium, and Miss Jane Taylor of the Kew Herbarium . . . took the trouble to look up the Dillenian specimens." Andrews did not take into consideration the nomenclatural worth of *S. capillifolium.*

The history of confusion concerning all these names, so well documented in the literature, is reviewed in interesting detail by Isoviita (1966). He considered the name *S. capillifolium* "valid, legitimate, and usable" and went on to explain that "its lectotype is the same as that of *S. capillaceum.* Since it is older than the latter, it would have to be adopted if the name *S. nemoreum* is rejected. . . . It would be very desirable, however, to preserve this old name [that is, *S. nemoreum*] in its present sense. But the justification of its use can be proven only by studies made at the type locality, and even then they would scarcely be of binding significance." *S. acutifolium* can be eliminated from consideration because of its relatively late appearance and because Schrader, on originating the name, referred to its synonymy Linnaeus' *S. palustre* var. β and thus included in his concept the original material of *S. capillifolium* and *S. capillaceum* as well! It is thus an illegal name.

In the absence of original material, one could give definition to *S. nemoreum* by designating a neotype. This means, in effect, conserving that epithet over one which is nomenclaturally acceptable. Isoviita favored the retention of *S. nemoreum* because that is the name sanctioned by usage in Fennoscandia (where much of the literature on *Sphagnum* originated.) For similar reasons based on American tradition, I like *S.*

capillaceum better. That is the name which Andrews used in his revision of the North American species (1913) and throughout his long career as the world's leading sphagnologist and the name which appears in most of the checklists, manuals, and floristic catalogues made available to American students. However, following Isoviita's own arguments and conclusions, I believe the best and only logical choice to be *S. capillifolium*. Such a choice necessitates nomenclatural changes regarding two entities which I have already treated as varieties of *S. capillaceum* (Crum, 1971, 1973):

Sphagnum capillifolium var. **tenellum** (Schimp.) n. comb.

S. acutifolium var. *tenellum* Schimp., Mém. Hist. Nat. Sphaignes 63. 1857.
S. rubellum Wils., Bryol. Brit. 19. 1855.

S. capillifolium var. **tenerum** (Sull. & Lesq. *ex* Sull.) n. comb.

S. tenerum Sull. & Lesq. *ex* Sull. *in* Gray, Man. Bot. No. U.S. (ed.2). 611. 1856.
S. evansii Warnst., Hedwigia 47: 100. 1907.
S. eatonii Warnst., *Ibid.*
S. nemoreum var. *tenerum* (Sull. & Lesq. *ex* Sull.) Nyh., Illus. Moss Fl. Fennoscandia 2: 725. 1969.
S. capillaceum var. *tenerum* (Sull. & Lesq. *ex* Sull.) Crum, Bryol. 74: 168. 1971.

The varieties of *S. capillifolium*—the var. *tenellum*, the var. *capillifolium*, and the var. *tenerum*—provide (in that order) an elegant example of the tendency for stem leaves to vary in the direction of branch leaves in shape and structure. Varying degrees of "hemi-isophylly" are found in several of the species and species-complexes of *Sphagnum* and have helped to give that genus a reputation for difficulty. Like many other kinds of variation in *Sphagnum*, isophylly can be related to differences in habitat, such as seasonal fluctuations in wetness (see Jensen, 1883; Åberg, 1937; Agnew, 1958; Mägdefrau & Winkler, 1966; Jelenc, 1970; Rahman, 1973). At their best and most typical expressions the various members of the *S. capillifolium* complex are easy to recognize by microscopic means, but they intergrade in such a way that they can sometimes be sorted out only by arbitrary decisions. While I grant that these are matters subject to individual interpretation, I find it convenient to recognize the differences, such as they are, at a low taxonomic level until it can be determined whether they are genetically meaningful or not. Environmental influences causing such variation are difficult to detect and analyze, because no dependable aspect differences can be spotted in the field.

The distinguishing features of the var. *capillifolium* are found in its oblong-ovate, involute-pointed stem leaves. The border is usually not much broadened at base. The hyaline cells are fibrillose on the outer surface and mostly resorbed on the inner. Large, rounded membrane gaps are often found on the outer surface of some cells. The var. *tenerum* has stem leaves more concave and pointed, with a lesser development of the basal border and with hyaline cells showing an abundance of elliptic pores along the commissures on the outer surface. The var. *tenellum* has flat, lingulate stem leaves with a broad apex and a well-marked, broad basal border. There are no pores or membrane gaps, and fibrils are generally lacking or reduced, but membrane pleats are well represented in the hyaline cells of stem leaves.

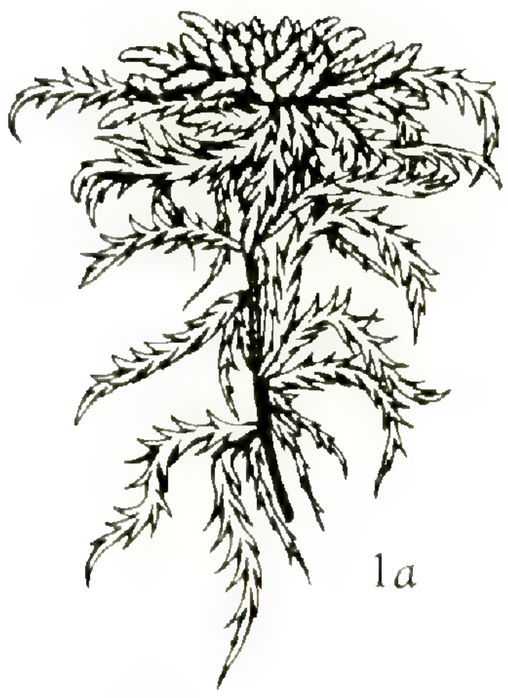
Were it not for the fact that the var. *tenellum* is so characteristic of the particularly oligotrophic and acid conditions of raised and blanket bogs in western Europe and other regions of high humidity (and often given the dignity of species rank, as *S. rubellum*), I would view it even more parsimoniously. In North America it is not at all restricted to oceanic climates or, as far as I have been able to determine, any particular environmental niche. In the continental interior and more commonly perhaps northward in the boreal forest, it is common and widespread on hummocks in both rich and poor fens. The habitat requirements need to be more intensively explored. I

think of the var. *tenellum* as occupying more elevated portions of hummocks and thus more acid-loving than the var. *capillifolium,* which however has a broad tolerance to conditions of pH and acts as a hummock former in the hollows and also occurs commonly in more acid conditions at the sides and tops of hummocks. Andrews once told me that he found the var. *tenellum* less distinctive here than in Europe. He stated in print (1959) that the variety should be recognized at some level even though intergrades make it impossible to separate some specimens except by arbitrary choice. It seems to be significant that Osvald (1940) also, with a background of extensive field work in Europe and in North America, found differences between the typical variety and the var. *tenellum* less impressive here than in Europe. At least in his North American studies, he considered them mere transitional forms.

The var. *tenerum* was previously considered essentially limited to the Coastal Plain in eastern North America. Andrews (1913) treated it at the specific level, but later (1959) characterized it as unsatisfactory species at best, ranging along the coast from Newfoundland to Alabama and inland to Tennessee. "Difficulty in identification rests especially upon the difficulty of giving a readily tangible diagnostic character. I have been obliged to limit the points of difference to the obese branches with very imbricate leaves which show an especially lax areolation with the empty cells (leucocysts) showing very strong convexity on the dorsal surface. This I will freely admit is not very satisfactory and while for the present disposed to maintain the species, I have no quarrel with anyone preferring to regard it as a variety of *S. capillaceum* and can at any rate understand the contention that it should be merged in this species." He had seen no material from Europe that was correctly named and thought that European records could be traced to a misunderstanding. He referred to this misunderstanding most specifically (and with irritation) in reference to Mrs. Lange's report from Denmark (1955). Andrews' valuable paper of 1933 presents further nomenclatural information of interest, on this taxon and also on a misuse of the name *S. tenerum* for something that he referred "rightly or wrongly" to *S. meridense* (Hampe) C. M. Elsa Nyholm (1969) included the taxon, as *S. nemoreum* var. *tenerum* (Sull. & Lesq.) Nyh., in the flora of Fennoscandia. Rønning (1958) preferred to consider it a modification of *S. nemoreum,* and Isoviita, in accounting for all the *Sphagna* of Europe (1966), said, "Like Rønning, I myself admit that my acquaintance with this species is deficient and is confined merely to herbarium specimens. If it were not for the fact that Andrews, well known for his broad concept of species, considered *S. tenerum* to be a distinct species, I would be willing to add this name to the synonym list of *S. nemoreum."*

Contrary to previous opinions, according to my understanding and definition, the taxon—whether species of variety—does indeed occur in northern and central Europe. I choose to call it *S. capillifolium* var. *tenerum.* I have seen specimens from the Caucasus and Japan. It is not uncommon in the interior of North America, ranging in fact across the continent, but it is most characteristic of the Atlantic Coastal Plain. It is variable in growth form and appearance, as well as in structure, but I have little trouble in recognizing it microscopically. As far as I have been able to determine. it shows little or no selectivity as to habitat, apparently occupying the same kinds of niches as the var. *capillifolium,* at least in inland localities.

The accompanying illustrations, prepared by Constance Butley, show the three epxressions of *S. capillifolium,* in their most distinctive forms but not the intergrades which make identification so difficult. The form of the capitulum, the shape of the stem leaf, and the degree of isophylly demonstrated by the stem leaf structure present a striking contrast at the extremes. Whether the differences vary with habitat conditions or whether they represent phylogenetic trends can scarcely be determined by sorting specimens or by casual observation in the field.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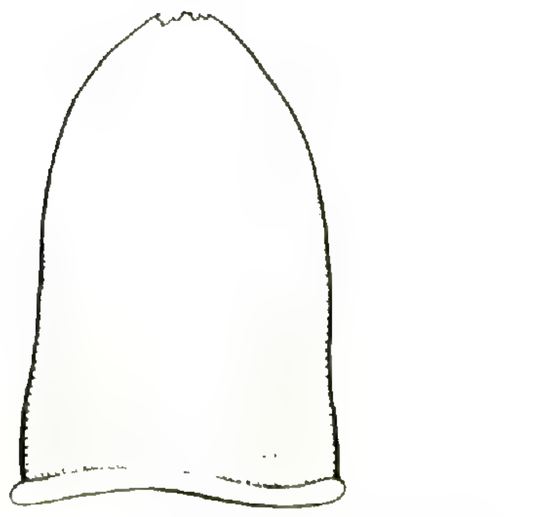
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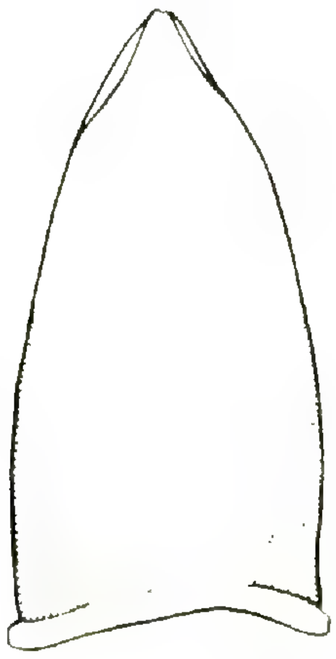
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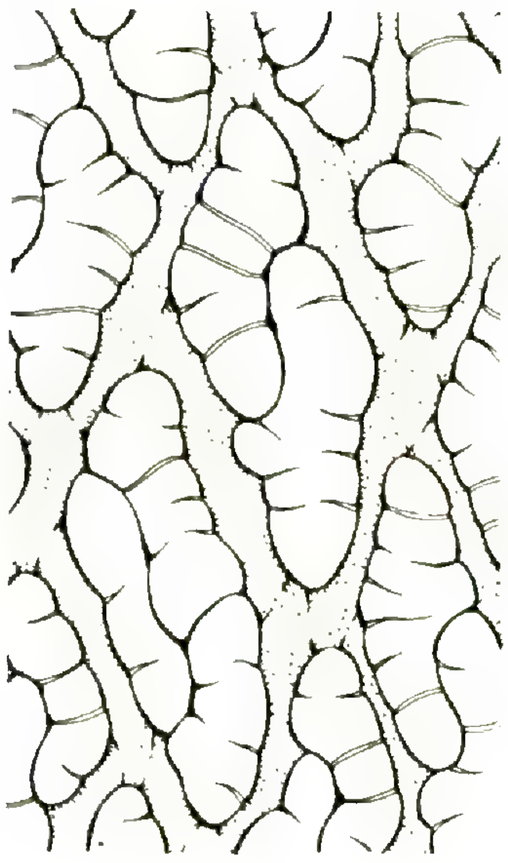

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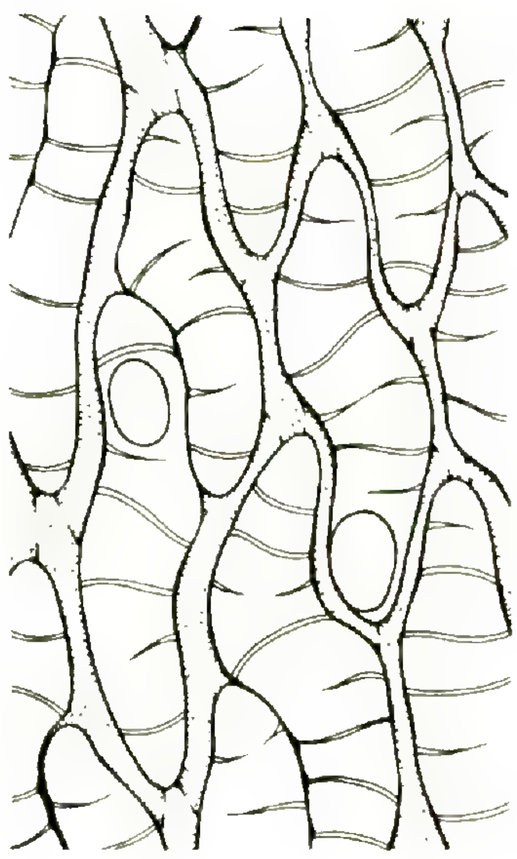

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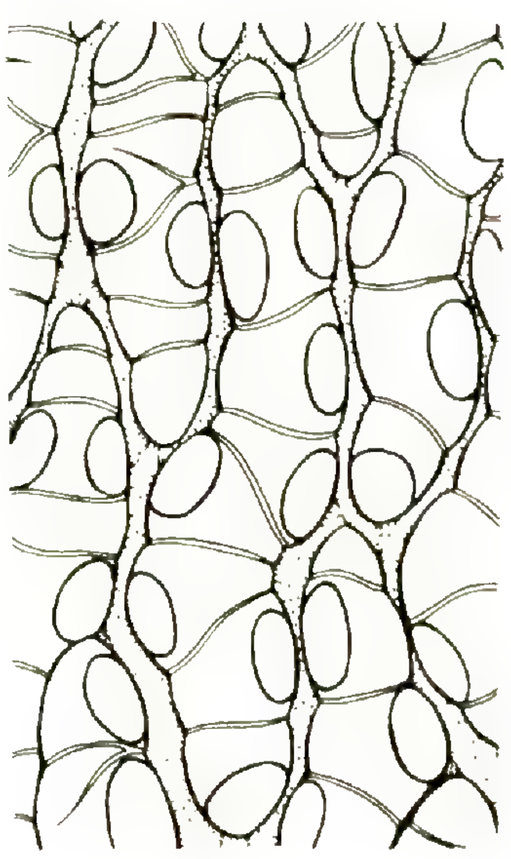

The *Sphagnum capillifolium* complex consisting of three intergrading forms shown here in their most distinctive expressions. Var. *tenellum*. 1a. Capitulum, ×2. 1b. Stem leaves, ×27. 1c. Cells of upper median portion of stem leaf, outer surface, ×400. Var. *capillifolium*. 2a. Capitulum, ×2. 2b. Stem leaves, ×27. 2c. Cells of upper median portion of stem leaf, outer surface, ×400. Var. *tenerum*. 3a. Capitulum, ×2. 3b. Stem leaves, ×27. 3c. Cells of upper median portion of stem leaf, outer surface, ×400.

I am grateful to Lewis E. Anderson for showing me *Sphagnum "tenerum"* at its best development in the Coastal Plain of North Carolina. I also acknowledge with gratitude support from the National Science Foundation (NSF–GS48809).

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BELONIA AMERICANA, SCOLIOCARPON PUPULA, AND ROBERGEA

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Upon examining the type collection of *Belonia americana* Fink *in* Hedrick, I discovered that it was a non-lichenized fungus unrelated to *Belonia* and that it was identical to syntype material of *Scoliocarpon pupula* Nyl. Further investigation suggested that this fungus belonged to the genus *Robergea* Desm. (Ostropaceae). Through the kindness of Dr. Robert L. Shaffer, University Herbarium, The University of Michigan, I have been able to compare it with material of the two previously known species of *Robergea, R. cubicularis* (Fr.) Rehm (Germany, near Geisenheim, *ex hb.* Fuckel 969 as *R. unica*) and *R. albicedrae* (Heald & Wolf) Sacc. & Trav. (Texas, Austin, 24 X 1908, *Heald & Wolf*). It is indeed a *Robergea* and differs from both the above species by its shorter spores. As a result, the genus *Belonia,* represented in North America only by *B. americana,* is excluded from the North American lichen flora. The correct name and synonymy for this species is as follows:

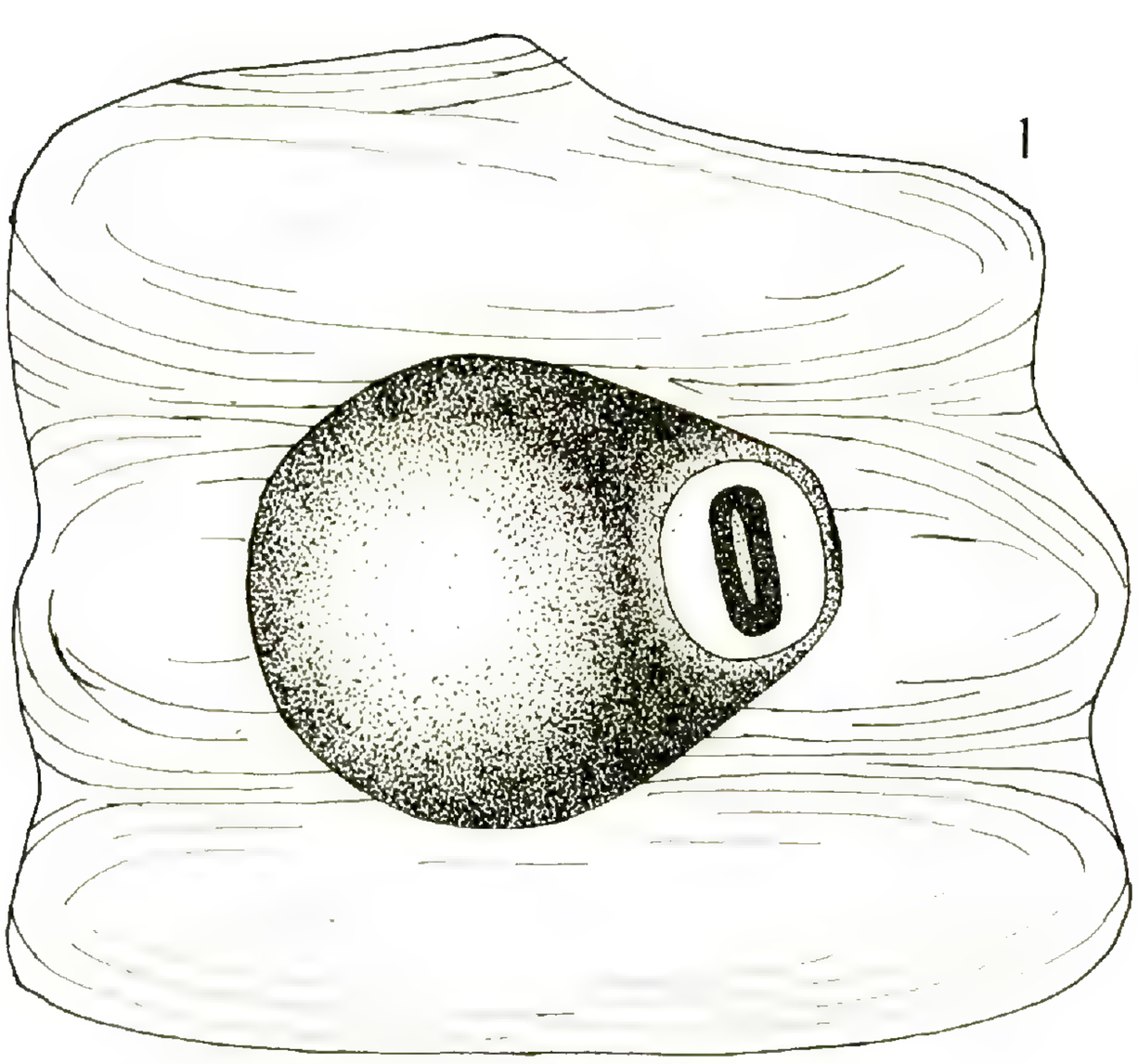
Robergea pupula (Nyl.) comb. nov.

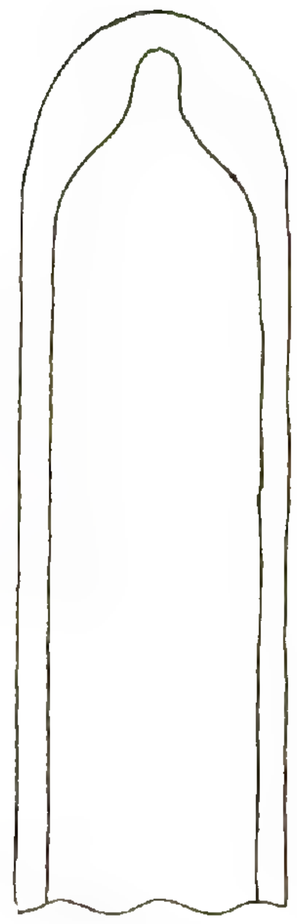
Scoliocarpon pupula Nyl., Mém. Soc. Acad. Maine Loire 4: 81. 1858.
Pyrenastrum? pupula Tuck. *ex* Nyl., *loc. cit., nom. inval. in syn.* ORIGINAL MATERIAL: . . . "ad cortices in Virginia et Carolina." Isosyntype in FH-TUCK 4005.
Belonia americana Fink *in* Hedrick, Mycologia 25: 309. 1933. HOLOTYPE: Texas, Houston, *Ravenel* (MICH, Fink Herb. no. 10,695).

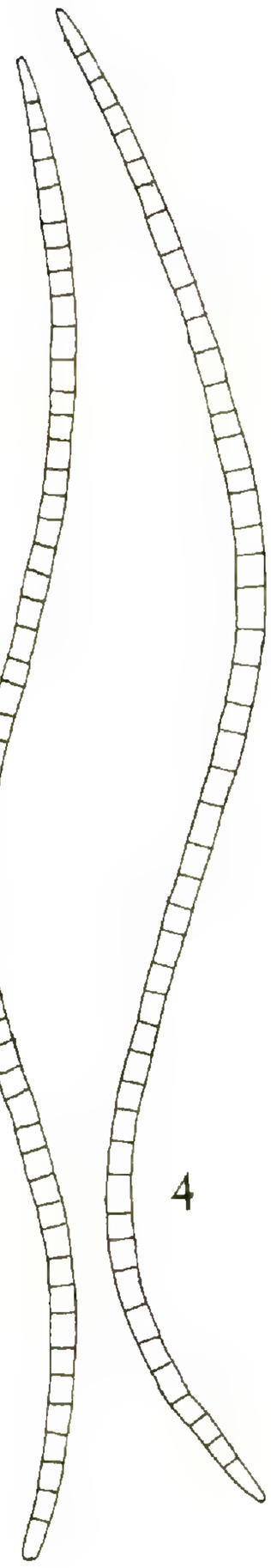
Robergea pupula is also involved in the typification of another fungus, *Polyblastiopsis dealbens* Fink *in* Hedrick, Mycologia 25: 307. 1933. At the time of Fink's death there apparently were two specimens in his herbarium bearing this epithet. When Hedrick published this name, she designated Fink Herb. no. 11,573 as the type. This collection is *Robergea pupula* and does not agree with Fink's original description. The other collection cited (Fink Herb. no. 11,252) agrees well with the description. In my opinion Fink Herb. no. 11,573 should be considered a lectotype selected by Hedrick and not a holotype. I would designate as a new lectotype the collection which matches the protologue (South Carolina, *Green,* Fink Herb. no. 11,252). If this is not accepted, then *Polyblastiopsis dealbens* must be treated as a synonym of *Robergea pupula.*

In *Robergea pupula* (fig. 1–4) the spores are 170–315 μ long as opposed to 300–600 μ long for *R. cubicularis* (Dennis, 1968) and 600–1000 μ long for *R. albicedrae* (Heald & Wolf, 1910). According to Dennis (1968), the ascocarp of *R. cubicularis* opens by a round pore, but in the specimen examined, the opening seems slit-like. In *Robergea albicedrae* the ascocarp opens by a definite slit, and in *R. pupula* the slit-like opening set in a white, pruinose disk suggested the epithet *pupula* (resembling an eye). *Robergea albicedrae* and *R. pupula* have the hymenium surrounded by a carbonized pseudostromatic layer which seems almost lacking in *R. cubicularis.*

Robergea cubicularis is apparently not known from North America, *R. albicedrae* was described from Texas on *Juniperus,* while *R. pupula* seems more widespread,







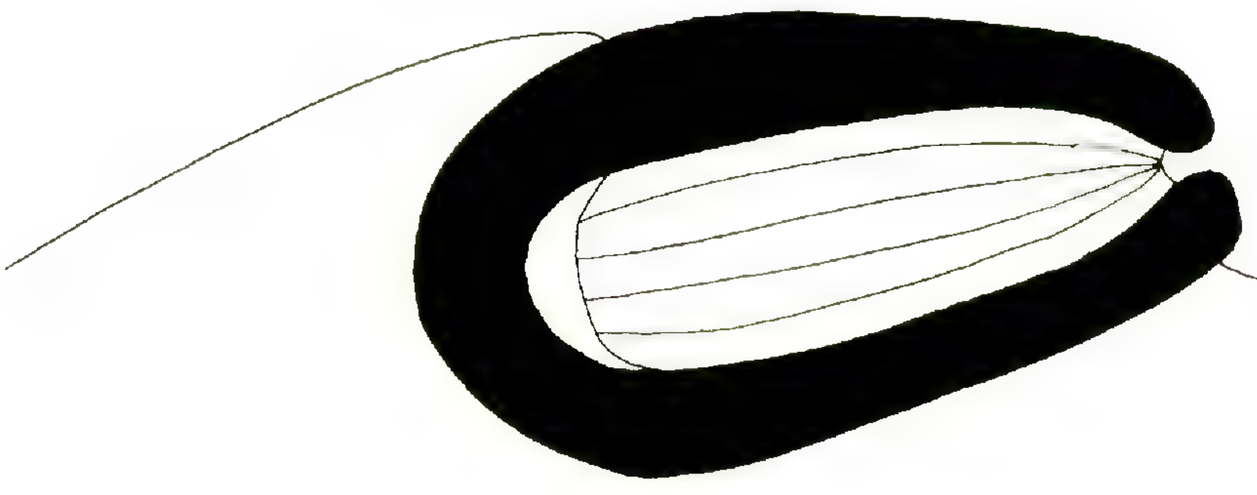


FIG. 1–4. *Robergea pupula* (Nyl.) R. C. Harris. 1. Habit, showing a single ascocarp on its bark substrate (oriented to conform to figure 2). 2. Longitudinal section of ascocarp. 3. Ascus tip. 4. Spores.

occurring on bark of *Quercus* and *Liquidambar*. The following specimens of *R. pupula* have been seen:

LOUISIANA: Natchitoches Parish, Kisatchie Nat. Forest 5 mi. SW of Montrose, *Tucker 7909* (MSC); Webster Parish, W side of Lake Bistineau, *Tucker 11441* (MSC). NEW JERSEY: Burlington County, Batsto, VI 1968, *Austin* (FH-TUCK 4005). SOUTH CAROLINA: Aiken County, Aiken, *Ravenel* (US *ex* MO). TENNESSEE: Hamilton County, Lookout Mountain, *Calkins* (FH, MICH). TEXAS: *sine loc.*, 1869, *Ravenel* (FH-TUCK 4005), 1848, *Wright* (FH-TUCK 4005); Harris County, Houston, 1869, *Ravenel* (MICH, US *ex* MO); Montgomery County, Sam Houston Nat. Forest E of Richards, 24 IV 1970, *Weber* (Lich. *exs.* Colo. 355, MICH, MSC). VIRGINIA: Kennico County, *sine loc.*, 24 XII 1852, *Tuckerman* (FH-TUCK 4005); Sussex County, Tower Hill, VI 1854, *Tuckerman* (FH-TUCK 4005).

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BOTANICAL RESULTS OF THE SESSÉ & MOCIÑO EXPEDITION (1787-1803)

I. Summary of excursions and travels

by

ROGERS McVAUGH

University of Michigan

CONTRIBUTIONS FROM THE UNIVERSITY OF MICHIGAN HERBARIUM
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For information, address the Director, Herbarium, University of Michigan, Ann Arbor, Michigan 48109.

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ABSTRACT

The names of almost 2500 supposedly new species and other taxa have been based on the plants collected by Sessé and Mociño and their associates. No sound basis for identification and typification of these names can be established without detailed knowledge of the routes over which the members of the Expedition travelled, and of the localities at which plants could (or could not) have been collected. This paper provides a narrative account of the travels of the various parties in Mexico, Central America, the Antilles, and on the Pacific Coast from California northward. An index to localities is appended, and a discussion of published and unpublished sources, including the posthumous floras entitled *Plantae Novae Hispaniae* and *Flora Mexicana.* Additional data, relative to the botanical results *per se* of the expedition, are available but are not included in this paper.

INTRODUCTION

The Royal Botanical Expedition to New Spain, known to many botanists as the "Sessé and Mociño expedition," was a major undertaking supported generously by the Spanish government for more than a decade after its authorization in 1786. The expedition was a success except for one thing: its findings were not published by those who took part in it, but trickled out piecemeal into the botanical world during the next century. The principal botanists of the expedition were almost forgotten until almost exactly a century after the initiation of the work in New Spain. In the period 1887–1894 two long floristic works based on the manuscripts of Sessé and Mociño were published in Mexico. Because of the many hundreds of supposedly new species in these works, the attention of botanists was newly directed not only to the names of Sessé and Mociño, but also to the work of the expedition in which they participated. With the upsurge of interest in the flora of tropical America in the 20th Century, it has become increasingly important to correlate the posthumous floras published in Mexico with the many other earlier publications in which fragmentary data from the Sessé and Mociño expedition were utilized.

The present paper aims to set forth in considerable detail the known facts concerning the travels of the expedition; that is, to provide a consecutive account of the times and places where the members of the group could have studied, collected, painted pictures of, or made notes upon, plants and animals. This attention to detail is especially important with respect to this particular expedition because of the very considerable numbers of plant-species from tropical America that have been based on the specimens and paintings of Sessé and Mociño, in the absence of any precise information about the sources of these specimens and paintings. Furthermore, the material remaining in the Sessé & Mociño herbarium in Madrid is for the most part without locality-data of any sort, and in future taxonomic studies it may often become essential to know whether or not a certain specimen *could* have been collected in a certain locality, even if it is not so labelled.

The background and organization of the *Expedición Real de Botánica* have been fully described by several authors. The account by H. W. Rickett (Rickett, 1947), based primarily on documents in the National Archives of Mexico, is perhaps the most readable and the best known. More recent accounts based primarily on Spanish archival materials are those of Wilson (1962) and Arias Divito (1968).[1]

No journal of the whole Expedition has ever been published; as far as I know nothing of the sort was ever kept, except for that of Longinos Martínez (Simpson, 1961). Type-localities are mentioned for most of the species published in the *Plantae Novae Hispaniae* and the *Flora Mexicana,* but many of the place-names are no longer current, or were garbled in publication. Most of the botanists who studied and described the Sessé and Mociño plants in the period between 1813 and 1880 were quite unaware of the possibility of providing definite localities for these collections. In the fashion of the 19th Century, most were content to cite the localities merely as "New Spain" or "Mexico," without any real knowledge of the origin of the plants. DeCandolle, for example, unless he had specific information to the contrary, assumed

[1]Published statements by Arias, by Rickett, or by Wilson, noticed in the text below, are from these same works. For permission to quote from the copyrighted material in Dr. Iris Higbie Wilson's thesis, I am greatly indebted to the author.

that the "Icones Fl. Mex. ined." were based on Mexican plants. Thus his *Mouriri mexicana* is actually a Puerto Rican species.

Our knowledge of where the Sessé and Mociño plants may have been collected comes chiefly from three sources:

1) Records in the *Archivo General de la Nación (Historia)* [Mexico]. This is abbreviated AGH in the text below. Here are hundreds of documents attesting to the presence of specific individuals in definite places on specific days, and also a wealth of information linking the isolated records so that one can form a reasonably well connected story of the whole *Expedición Botánica* and its travels. Much of the story has been set forth already by Rickett (1947).

2) Records in Madrid, especially in the archives of the Instituto Botánico "A. J. Cavanilles." Of special value here are lists of plants collected on the different excursions, lists of *Icones* painted during the excursions, lists of the entire herbarium as it existed at different periods, etc. Many of these lists and other documents have been reproduced in full or quoted in part by Alvarez López (1952, 1953), by Wilson (1962), or by Arias (1968).

An important additional source that has received little attention from botanists is Mociño's unpublished manuscript of a "Flora of Guatemala" [not a formal title]. This is in the archives of the Instituto Botánico (4ª división, núm. 13). It is a list of about 553 species arranged by Linnaean classes, evidently intended for eventual publication. The species are chiefly those encountered by Mociño during his trip to Central America, 1795–1799, but there are also many references to places in eastern Mexico, including those visited by Mociño in 1793–1794, e.g. Ahualulco, and Tuxtla, Veracruz. Species are briefly characterized, or the statement is made that all those (of a genus) previously known from Mexico are known from Guatemala also. Many new unnamed genera are included. Localities for the species listed include a few from Oaxaca, many from Chiapas, Guatemala, Salvador, and Nicaragua, and a few from Costa Rica. Study of these localities provides much detailed information about Mociño's travels in Central America.

3) Published records in the *Plantae Novae Hispaniae* and the *Flora Mexicana.* It was the practice of the members of the *Expedición Botánica* to follow the description of each species by a formal statement of habitat, locality or localities from which the plant was known, and time of flowering. Thus a typical statement might be:

Habitat prope clivum vulcanicum del *Colli* juxta Guadalaxaram. Floret Julio.

Few botanists seem to have noticed the fact first pointed out by the geographer Donald D. Brand [in *Coalcomán and Motines del Oro,* pp. 220–222. The Hague, M. Nijhoff. 1960], namely that by tabulating the localities cited in the *Plantae Novae Hispaniae* and the flowering times cited for each locality, it is possible to follow the expedition chronologically on its trip of 1790–91 from Mexico to Querétaro, Guanajuato, Morelia, Apatzingán, Colima and finally to Guadalajara. The sequences of localities visited in other years can be worked out in the same fashion and equally satisfactorily. For more detailed discussion of the contents of *Plantae Novae Hispaniae* and *Flora Mexicana,* see text p. 111.

The members of the Expedition–botanists, "naturalists' (we should say zoologists), artists, and helpers–began the exploration of Mexico in 1787. The surviving members left Mexico to return to Spain in 1803. In the intervening years they had explored, together or separately, much of central, southern, and western Mexico; they had travelled the length of Baja California, had penetrated the coastal parts of Alta California and southern Alaska from sailing vessels and made an extended stay in Nootka off the coast of Vancouver Island; had collected in the vicinity of Havana, Cuba, and at many localities in Puerto Rico; and had travelled the long road from Mexico City to the frontiers of Costa Rica and return.

Some manuscripts, specimens, and paintings were returned to Spain while the

Expedition was in Mexico. The rest of the accumulation of more than 15 years' work went back with the *expedicionarios* in 1803. Apparently almost no botanical materials were lost; from a logistic standpoint the Expedition had been a success, even though unduly prolonged. Many thousands of specimens, representing more than 2000 species of plants, together with paintings and descriptions of most of the species, were assembled in Madrid in anticipation of the ultimate publication of a *Flora de Nueva España.*

Unfortunately these plans never came to full fruition. In 1803 and for some years thereafter the government of Spain was in turmoil, and conditions were not favorable, to say the least, for the publication of expensive illustrated works on Natural History. Don Martín de Sessé y Lacasta, the Director of the Expedition since its inception, and one of its two active botanists, died in 1808. The other active botanist, José Mariano Mociño, died in 1820, having been a political exile from Spain since 1812. After Mociño's death a remarkable series of events combined to keep alive the names of Sessé and Mociño, and at the same time to entangle the threads of their work almost beyond unraveling. The scenario developed as follows:

1. The herbarium specimens collected in America by Sessé and Mociño and their associates remained in Madrid, where after a series of vicissitudes they became a part of the holdings of the Real Jardín Botánico, now the Instituto Botánico 'A. J. Cavanilles.' The major set, approximately 8000 specimens, representing most of the species the botanists had encountered, remained in storage until 1935; no one studied or annotated the specimens, which were essentially forgotten by the scientific world, and contributed nothing to the developing picture of taxonomy in the 19th Century.

2. The paintings that had been prepared in the New World to accompany the new *Flora Mexicana,* were lost, but about 225 "duplicates" made by the original artists, and more than 1000 additional copies made by other artists, found a home in Geneva, where they were studied by various European botanists. They are important to history and to plant-taxonomy because almost 300 of the paintings were used as the types on which rest the names of a corresponding number of species new to science. Those who described these new species depended entirely on the paintings; for the most part they never saw any specimens of the plants from which the *icones* were made.

3. "Duplicate" plant-specimens to the number of several thousand were extracted from the Madrid herbarium and sold, mostly between 1814 and 1828, to private collectors. In 1842 one very large collection was dispersed by public auction, with the result that the Spanish duplicates became widely scattered in European herbaria. Because many botanists studied them and published upon them, they became scientifically more valuable than the original herbarium that remained in storage in Madrid. These duplicates, from about 1820 to about 1880, served as types of the names of more than 500 new species, additional to those names based on the paintings in Geneva.

4. At the Madrid garden the resident botanists had been receiving American seeds and other propagules from Sessé and his associates since the beginning of the Botanical Expedition in 1787. Many of the seeds grew and produced plants that were thought to be new species. Between 1791 and 1816, about 250 supposedly new names were based on these garden-grown plants. Many of the names published by the Spanish authors are the earliest for the plants in question, but the names were not always known to (or not accepted by) the non-Spanish botanists who were busy describing and naming what they took to be novelties among the Sessé and Mociño paintings or among the duplicates in various European herbaria.

5. Descriptions of, and notes on, more than 2000 species observed in the New World by Sessé and Mociño and the others, remained in Madrid with the original set of the herbarium, and are indeed still in the archives of the Instituto Botánico. A very

large number of the descriptions were in more or less final form, destined for inclusion in an organized flora. With the resurgence of botanical activity in Mexico after 1870, more than half of the manuscript material was published in that country between 1887 and 1894, with the result that almost 1500 new names for American plants were added to the already over-burdened literature of systematic botany. Most of the names were "new" only in the technical nomenclatural sense, but in reality a century out of date. Most of the species described in the posthumous floras had already been described and named by other authors during the intervening century. Many of the specific epithets had already been used in the same genera. Thus both botanically and bibliographically the publication of the *Plantae Novae Hispaniae* and *Flora Mexicana* was unfortunate.

However, the publication of floras based on the 18th Century manuscripts of Sessé and Mociño focussed the attention of scholars on the flood of new names based on the Sessé and Mociño paintings, the Sessé and Mociño duplicates sold by Pavón, and the living plants grown at the Madrid gardens from Mexican and other seeds provided by Sessé and Mociño. The names published between 1887 and 1894 were all listed in the 7th supplement of the *Index Kewensis* in 1929 and soon thereafter in the *Gray Herbarium Card Index,* so that even those who did not have access to the rather scarce original publications became aware of the existence of the names.

6. About 1930 Paul C. Standley determined to make an effort to identify as many as possible of the Sessé and Mociño species by comparison of the descriptions and other information in the posthumous floras of 1887–1894, with specimens in the herbarium of Sessé and Mociño that had been in storage in Madrid. At the instigation of J. Francis Macbride, and with the cooperation of Dr. José Cuatrecasas, then Jefe de la Sección de Flora Tropical of the Instituto Botánico 'A. J. Cavanilles,' the entire collection was sent on long-term loan to the Field Museum, in Chicago, for study by Mr. Standley. In May, 1936, when the collection arrived in Chicago, Standley was at the height of his powers, the acknowledged authority on the flora of tropical America, and indeed the only person in the world who might justifiably have attempted the task of organizing and identifying such a collection. Standley originally intended to publish an enumeration of the herbarium, i.e. merely a list of the species represented in it.

7. Standley became involved in other activities after about 1940. The systematic arrangement, cataloging, and listing of the herbarium was completed under the direction of Theodor Just, from about 1950 to 1956. In the latter year, at the request of Dr. Just, I began with the assistance of many colleagues to complete the identifications and to prepare for publication an account of the entire collection. The identifications having been completed as far as possible, the last of the herbarium was returned to Madrid in 1964.

8. It was decided that listing of the specimens in the Sessé and Mociño herbarium would be in itself an academic exercise, but that a more useful contribution might be the description and assessment of the total botanical contribution made by the Royal Botanical Expedition. To this end, with the support of Dr. Just's successor at Chicago, Mr. John A. Millar, I undertook to collate the specimens in the Madrid herbarium with the descriptions in the *Flora Mexicana* and the *Plantae Novae Hispaniae,* with the duplicate specimens in other herbaria, and with the paintings and other manuscript materials of the Expedition. I visited, in 1963 and subsequently, the most important repositories of Sessé and Mociño material in the United States, in Mexico, and in Europe. With the full cooperation of the authorities of these institutions I was able to locate most of the relevant material.

The data have now been organized and assembled so as to present to the community of systematic botany an enumeration and evaluation of the specific accomplishments of the Expedition, and some predictions of how the *reliquiae* of the

Expedition may influence taxonomy and floristics in the future. The present paper is intended to be the first step in the presentation of these data.

It is a pleasure to acknowledge here the fine cooperation I have received over the last two decades from my friends at the Field Museum, which originally sponsored my part in the project; in Madrid, where I was privileged to consult the archives in 1963; in Mexico City, at the National Archives and elsewhere; and in many other botanical centers in the United States and in Europe. In the preparation of the geographical lists I have drawn freely upon the knowledge of Alain Liogier, Jerzy Rzedowski, Luz María Villarreal de Puga, Jacob L. Whitmore, and others for whose contributions I am most grateful.

PERSONNEL OF THE EXPEDITION

Very little new information can be added to that contained in the accounts by Rickett (1947), and Arias Divito (1968).

As originally constituted by Royal Order of 13 Mar 1787, the Expedition included "[Don Martín de] Sessé por Director, así del Jardín como de la Expedición: a Dn. Vicente Cervantes para Cathedrático de Botánica y a Dn. Juan del Castillo y a Dn. Josef Longinos Martínez para que agregándoseles en calidad de Profesor Farmacéutico Dn. Jayme Senseve, residente en esa Ciudad, y los dos Dibujantes, que se enviarán de estos Reinos en caso de no haberlos en ese dotados de las debidas circunstancias, ejecuten la insinuada Expedición, en compañia, y a las órdenes del Director; auxiliándoseles con dos o tres negros criados o prácticos, costeados por cuenta de la Rl. Hacienda" (Arias, p. 72). That is to say, Sessé was to serve as Director of the Expedition as a whole, and also as Director of the Botanical Garden to be established in Mexico City. Cervantes was to hold the Chair of Botany, Castillo and Longinos were specifically named but without title, Senseve as Professor of Pharmacy. Two artists were to be hired, and two or three servants were also to be supported from the Royal treasury.

Of these first appointees, Sessé was trained in medicine, Cervantes in pharmacy and botany, Longinos in botany and anatomy, Castillo and Senseve in pharmacy. Two young Mexican artists, Vicente de la Cerda and Atanasio Echeverría, were soon added to the group. As time went on the composition of the staff changed. Sessé seems to have become more and more interested in botany. Castillo died, and was replaced by Mociño, who was primarily a botanist by inclination. Senseve proved to be a noncontributing member of the Expedition. Maldonado, an anatomist, for a time took the place of Longinos who separated himself from the rest of the group. The effect was a general increase of emphasis on botany for its own sake, and less interest in zoology and in the more practical aspects of botany. As Rickett notes, the Expedition might more properly have been styled the Natural History Expedition, but by its contemporaries it came to be called "la Expedición Botánica."

Sessé

Martín de Sessé y Lacasta (1751–1808), a Spaniard, conceived the idea of the Botanical Expedition to New Spain, and acted as its administrative head during the whole period it was active in America.

Several of Sessé's notebooks, and numerous plant-descriptions in his handwriting, are preserved in the archives of the Botanical Garden in Madrid; enough to make clear that he was not only an appointed supervisor of the field work in Mexico but an active participant. He took part in the field work of the first three "Excursions" (1788–1791), he led an excursion to the State of Mexico in 1792, and another the same year to Hidalgo, Veracruz, and Puebla. In 1793 he explored in Veracruz and Puebla as far as his health would permit. Both Rickett (Chapter 3, pp. 41–45) and Wilson (pp. 228–244) have described Sessé's activities in the West Indies, when most of the actual botanical collecting and note-taking must have devolved upon him, as his only assistant was the ineffectual Senseve.

After the return to Spain late in 1803, Sessé seems to have continued, as long as he was able, to study and annotate the collections made in America. He worked with the manuscript pages of what was ultimately published as *Flora Mexicana*, and took a principal part in the study and annotation of the present Sessé and Mociño herbarium.

In short, Sessé's principal contribution probably was as an organizer and administrator. His botanical contribution, though considerable, was secondary to that of Mociño. A brief biography of Sessé recently appeared in Dict. Sci. Biog. 12: 326–328. 1975.

Cervantes

Vicente Cervantes (1755–1829), like Sessé a Spaniard, was a pupil of Gómez Ortega in Madrid. He became Professor of Botany at the new Botanical Garden in Mexico City in 1787, and remained at the garden until his death. His reputation as a botanist depends not on his ability as a field investigator, for because of his heavy responsibilities at the Garden, or for other reasons, he did not accompany the other botanists on their "excursions." It was Cervantes, however, who primarily retained and strengthened the contacts between the botanists in Mexico and those in Spain. His contributions to the Botanical Garden in Madrid were repeatedly acknowledged, from 1790 to 1814, by Ortega, Cavanilles, and Lagasca. Arias (p. 40) says that as late as 1815, in the midst of revolution in Mexico, Cervantes sent a shipment of seeds of 281 Mexican species to Madrid.

Mociño

José Mariano Mociño (1757–1820), Mexican-born of Spanish descent, qualified in philosophy, theology and ethics, then trained in medicine before settling on botany.

Although Mociño later came to be identified with Sessé as one of the two authors and planners of the new *Flora Mexicana,* his connection with the Botanical Expedition began at a relatively late date, and for a time was unofficial or at least irregular. In 1790, at the beginning of the "Third Excursion," Sessé recommended that Mociño take the place in the field that should have been occupied by the unfortunate Senseve, who was to remain in Mexico City. This scheme was approved, and Mociño accompanied the field-party for the next year and a half, until he was ordered to join another Spanish expedition, this one to the Pacific Northwest. When he returned from Nootka in the spring of 1793 he found himself technically without employment, his appointment having been cancelled by Royal Order of 22 Mar 1791. Nevertheless he continued his botanical work under the direction of Sessé until he was given a full appointment as a member of the Expedition after the death of Castillo on 26 Jul 1793. Of all the botanists of the Expedition he became the most widely traveled, his botanical explorations having taken him across the whole of Mexico at the latitude of Mexico City, north in the Pacific lowlands as far as Alamos, Sonora, and southeastward into Tabasco, Oaxaca, and Chiapas. Beyond the borders of Mexico he touched down in California and spent a summer season on Nootka Island; and finally he led an expedition overland for more than three years, through the length of Central America and return.

After joining the Expedition, Mociño seems rapidly to have forged ahead as the most productive and active botanist, associated with the Director, Sessé, in the production of a new *Flora Mexicana.* Part of this may have been because of his undoubted interest in botany, his competence in Latin, and his interest in intellectual things generally. Part of it was certainly because the other members of the Expedition

failed in some way to measure up to expectation. Of the two pharmacists attached to the group, Jaime Senseve was ineffectual and, in Rickett's words (p. 25), poorly qualified, a "lamentable creature." The other pharmacist, Juan del Castillo, was competent enough but plagued with illness almost from the beginning of the fieldwork. The "naturalist," José Longinos Martínez, was interested in animals rather than plants, he was (according to Sessé) quite ignorant of Latin, and his personality made it impossible for him to work with Sessé.

Whatever may have been the reasons, Mociño kept most of the records of what the Expedition accomplished. The existing lists of specimens in the herbarium, and of *icones* prepared for the *Flora Mexicana,* are almost all in his hand. He prepared the manuscript that was sent to Spain in 1791 as a record of the first three years of the Expedition's work, the same manuscript that was eventually published as *Plantae Novae Hispaniae.* After the return to Spain he began the reorganization of specimens and pictures with the intention of preparing a new and definitive *Flora Mexicana.* When he was forced out of Spain in 1812 he carried with him the manuscripts and the paintings upon which that flora was to be based. To the end he continued his dedication to the objectives that had been those of the *Expedición Botánica* from the first. A brief biography of Mociño was recently published in Dict. Sci. Biog. 9: 432–434. 1974.

Longinos Martínez

José Longinos Martínez (?ca 1750–1802), a Spaniard, was an early associate of Cervantes, and like Cervantes a student of Ortega in Madrid. He was trained in botany, but his primary interest seems to have been in zoology. After the work of the Expedition began in Mexico, Longinos gradually dissociated himself from the others, and became increasingly antagonistic toward them, especially toward Sessé. Early in 1791 he undertook a long expedition to the Pacific Coast, independent of the rest of the Expedition. For an account of his subsequent wanderings see text, p. 134, or see Rickett (pp. 46–54) or Simpson (1961). Longinos' most important legacy seems to have been the journal of his wanderings, which survived and was edited and published by Simpson (1961). His surviving botanical collections total no more than a half-dozen specimens, and there is no evidence that he made any substantive contributions to the *Flora Mexicana* or the *Plantae Novae Hispaniae.*

Castillo

Juan Diego del Castillo (1744–1793), a Spaniard, was a pharmacist, one of the original appointees to the staff of the Botanical Expedition. He took an active part in the explorations from 1788 until his death.

Senseve

Jaime Senseve (?–1805), was apparently a Spaniard, a pharmacist who held a hospital position in Mexico when the Expedition was organized. He remained a member of the Expedition to the end, but his botanical contributions were minimal. He accompanied Longinos to Baja California in 1791–92, and Sessé to the West Indies, 1795–1797, and returned to Spain with Sessé in 1804.

Maldonado

The modern printed labels attached to the Sessé & Mociño herbarium in Madrid bear the words "Plantae Novae Hispaniae a Sessé, Mociño, Castillo et Maldonado lectae (1787–1795–1804)." If it were not for these labels, the name of José María Maldonado might well be forgotten.

Maldonado was apparently a native of Mexico. He was a classmate of Mociño's in the course of botany taught by Cervantes. Both graduated in November 1789. Maldonado spoke at the graduating exercises upon the subject of the fructification as providing sure and certain characters for determining genera. Both Maldonado and Mociño performed creditably upon this occasion, and soon thereafter both were offered places in the Expedition, partly in an effort to make up for the failure of Senseve to contribute to the scientific work. Maldonado's specialty, in spite of his proficiency in botany, was not in that subject but in surgery and anatomy; he was in fact often referred to as a surgeon. His first assignment was in the dissection of animals, "por su particular genio anatómico" (Arias, pp. 107, 136). Rickett (p. 27), in writing of Mociño, mentions "the anatomist Maldonado who had been appointed at the same time."

I do not find any record of Maldonado's doings from 1789 to the end of 1791. Apparently he did not participate as a paid member of the "Third Excursion" to Guadalajara and the Pacific Coast in 1790–1791, but Sessé, in writing later of his own travels in the autumn of 1791, stated that he and Maldonado and one of the painters had explored the Pacific lowlands as far north as the Río Yaqui.

Rickett (p. 29) notes that Maldonado was ordered to join Mociño on the Nootka expedition that left San Blas on 29 Feb 1792. This was the *Expedición de los Límites al Norte de las Californias,* commanded by Juan Francisco de la Bodega y Quadra. Wagner & Newcombe (1938, p. 192) state that Maldonado sailed on the brig *Activa,* which left San Blas on 5 Mar 1792. After Jacinto Caamaño, in the *Aranzazú*, arrived at Nootka on May 14, Maldonado was assigned to his company, which left Nootka on 13 Jun, and returned on 8 Sep; see Bucareli, in the gazetteer. Maldonado prepared a list of the fauna and flora found near the port of Bucareli (Arias, p. 412), and also assisted Mociño in drawing up a catalogue of more than 200 plants found on the voyage to California and Nootka (Arias, pp. 408–411). Presumably he returned to San Blas with Mociño in 1793, but I find no further mention of him.

Echeverría and Cerda

The Royal Order of 13 March 1787, directed to the Governor of New Spain, specifically named the naturalists who were to take part in the Botanical Expedition. Also mentioned were "two Artists who will be sent from these Reigns in case of not having them in those parts [i.e. Mexico]." (Wilson, p. 10).

Sessé had little trouble finding two capable artists in Mexico. With the advice of the Director of the Royal Art Academy of San Carlos in Mexico he appointed two young men, Juan de Díos Vicente de la Cerda, and Atanasio (or Athanasio) Echeverría y Godoy. Both appointments seem to have been made sometime in the autumn of 1787. The best account of this is by Arias (pp. 44 45, 76–77), who describes the two as "jovencitos, dóciles y vivísimos en el trabajo." Probably Cerda's first trial paintings were made in October, 1787, and those of Echeverría soon thereafter. By the beginning of May, 1788, the two artists had already finished about 200 plates.

Vicente de la Cerda distinguished himself at first; to quote Arias again (p. 44), "Se destacó al comienzo hasta que Echeverría apareció, excediendo a todos sus compañeros en habilidad." Echeverría soon became Sessé's favorite, and there are

various references to him thereafter as the better of the artists. Both Arias and Wilson (p. 25), quote Sessé's letter to Ortega in which he says (27 Jun 1788) in lauding Echeverría that the latter finished in one day four paintings of plants, and one of a butterfly "so completely enchanting that it appears to want to escape from the paper." At this time Echeverría, according to Sessé, was not yet 16 years old.

The botanical field-parties always included one or more of the artists. After preliminary work in and around the Valley of Mexico, both artists took part in the "Excursion" to Guerrero in 1789, and in the longer trip of 1790–92 to the Pacific Coast. Echeverría and Cerda were both in Tepic on 15 February 1792, after which the former accompanied Mociño on the Nootka Expedition, while Cerda returned to Mexico with Sessé and later the same year went with him for some weeks to the State of Mexico, and following that to the Atlantic Slope for the rest of the autumn.

In 1793 Echeverría worked with Sessé in Veracruz and Puebla, then later with Mociño in southern Veracruz. Cerda spent a part of the spring with Mociño after the latter's return from Nootka in April, then remained with Sessé when Echeverría went off with Mociño in August or September. The record seems to be silent about Cerda in 1794, when Sessé was in Mexico much of the time; Mociño was in the Southeast during much of the same year, and Echeverría was with him at least for the first part of the year (Rickett, p. 33).

In 1795 Cerda began with Mociño their long trek to Guatemala, from which they returned three and a half years later. At about the same time Echeverría left with Sessé for the West Indies. We know something about the work of the artist in Cuba and Puerto Rico. He took with him to Cuba the 200 or so sketches from the Nootka Expedition (which he had promised to complete); how much was eventually completed I do not know. At the end of August, after 3 months in Havana, Sessé noted that the artist was ill and could not even work at the unfinished sketches (Rickett, p. 42). Even by the first of the following March (AGH 465^3: 17) he had not completed the paintings. On the other hand, we know from one of Sessé's letters (in March 1797), when they were ready to leave Puerto Rico, that they had drawings of nearly 300 plants.

Villar

The least known but still identifiable member of the Botanical Expedition, Julián de Villar Pardo, was a native of the province of Rioja in Spain, who served with the Malaspina Expedition as scribe to Antonio Pineda. He remained in Mexico after Pineda departed, and made himself useful to the group headed by Sessé. Villar apparently was skilled in dissection of animals, and also had some botanical knowledge, and the ability to compose descriptions. We first hear of him in April 1793, when he was ready to set off with Sessé for the Atlantic Slope. He accompanied Mociño on the latter's two ascents of the active volcano of San Andrés de Tuxtla, in September and October, 1793 (Rickett, pp. 31–35). In 1795 Sessé sought unsuccessfully to have Villar accompany him to Cuba. Mociño and Cervantes then petitioned the King to have Villar added to the group that was going to Guatemala, saying that Villar had offered to work without salary, so great was his devotion to the work. They stressed his competence in Zoology, and in the Latin and French languages. The petition was ultimately refused, on the grounds that Villar was not a "Profesor," but the various accounts agree that Villar did accompany Mociño and Cerda on the trip to Central America that began in June 1795. Arias (p. 196) notes that he was given an official status in 1797, after another request by Mociño from Guatemala, with support from the President of Guatemala. Presumably he returned to Mexico with Cerda in 1798, or a little later with Mociño. I find nothing about him after that time. We know nothing of what his real contribution may have been to the botanical part of the Expedition.

Correspondents

The Sessé and Mociño herbarium contains a few specimens that are definitely stated to have come from persons not formally connected with the *Expedición Botánica.* It seems probable that other plants, not specifically identified as to source, came into the herbarium in the same way.

For example, two species of the Texano-Mexican frontier, where the members of the Expedition never travelled, are attributed to Don Ignatius de León (the plants are *Ehretia anacua,* and *Jatropha cathartica*). Colmeiro (1858, p. 212) mentions the name of Ignacio León, stating that he was a pharmacist ["Boticario"] who sent seeds to the Botanical Garden in Mexico during the time of Cervantes, and that LaLlave and Lexarza had dedicated the genus *Leonia* to him. Rickett (p. 81) includes the name of Ignacio León y Pérez among those who graduated from the course in Botany at the Botanical Garden in Mexico, in 1794. Arias (p. 112) also mentions this, and (p. 118) says the following:

"Don Ignacio León y Pérez, cacique principal de San Juan Acázingo y Profesor de Farmacia, asistió durante tres años a los cursos de Botánica. Luego, como Correspondiente del Jardín en el Presidio de Santa Rosa, hizo varias remesas de plantas."

The citation by LaLlave & Lexarza (1825, p. 6) is as follows:

"Genus dicatum D. Ignatio Leon, ex nobilium Tlaxcaltecarum genere, et Chimalpopocarum sanguine orto, Pharmacologiae et Botanices Profesori, qui plurimis seminibus novorum generum et specierum in Praesidio de Sancta Rosa collectis, hortum Mexicanum ditavit.–Cerv."

As Arias notes, there are preserved in the archives of the Royal Botanical Garden (4ª Div., núms. 14, 21) some communications from León to Sessé, in 1792 and 1793, from el Valle de Santa Rosa, including lists and descriptions of plants. (See Santa Rosa, in the gazetteer.) León later (1801) wished to obtain the title of Botanist.

An even less well-known associate of the Expedition is Don Antonio Cal. It is he presumably to whom the genus *Calibrachoa* was dedicated by LaLlave and Lexarza. Colmeiro (p. 209) names him Antonio Cal y Bracho, and says he was a student at the Botanical Garden at Madrid, and an associate of the Garden in Mexico, a man principally devoted to Pharmacy. The Sessé and Mociño herbarium contains at least four specimens definitely attributed to "D. Cal." Rickett apparently does not mention him. Arias (pp. 185–186) mentions an unsuccessful attempt by Sessé to replace the naturalist Longinos by Antonio Cal and Julián del Villar.

The citation by LaLlave & Lexarza (1825, p. 3) is as follows:

"In honorem Antonii de la Cal et Bracho, horti Matritensis alumni, horti Mexicani socii, Pharmaciae, Chemiae et Botanices optime meriti Profesoris.–Cerv. D."

SESSÉ & MOCIÑO MANUSCRIPTS PUBLISHED IN MEXICO

As mentioned above, an important if perhaps unfortunate aftermath of the Botanical Expedition was the publication of two volumes of Sessé & Mociño manuscripts a century after their preparation, and long after both style and content had become obsolete. The two works, entitled *Plantae Novae Hispaniae* and *Flora Mexicana,* are very different in content and in floristic value, though they are superficially similar in arrangement and format. Both were published originally in installments, as supplements to the Mexican periodical called *La Naturaleza,* then each work was issued in a "second edition" in book form after some editorial changes. In brief, *Plantae Novae Hispaniae* is a real flora, prepared as a unit, and intended to name and describe the Mexican plants studied by the Expedition during their first three years in the field. *Flora Mexicana* is in no sense a unit, constituting a "flora" only in the sense that the almost 1500 included species are arranged approximately according to the Linnaean system. It includes a miscellany of species from all parts of America visited by the Expedition, including at least 450 already included in *Plantae Novae Hispaniae.* It can perhaps be best characterized by describing it as a collection of preliminary notes and manuscripts that had been kept together with the idea of one day using them in the preparation of a definitive flora. The two works are discussed separately below.

The story of the events leading up to publication of the manuscript of *Plantae Novae Hispaniae* and that of *Flora Mexicana* was recounted in brief by Ricardo Ramírez (1894), in the introduction to the second edition of *Flora Mexicana.* The *Sociedad de Historia Natural de Mexico,* having learned in 1870 that manuscript versions of a flora of Mexico existed in Madrid, began efforts to obtain access to the manuscripts, and permission to publish them. It was not until 1883, through diplomatic channels, that the necessary permission was secured. The Society was unable to find a way to reproduce the *Icones,* most of which were in the possession of the DeCandolle family in Geneva, but decided to publish the texts without illustrations. Publication began in 1887 and continued for a decade.

The "first editions" of the two texts follow the original manuscripts closely. In the second editions an effort was made to correct errors and to modernize the spelling. In the manuscripts and in the first printed versions the letter "I" is almost invariably used in place of "J" and the letter "U" in place of "V." As far as I have noticed, "V" does not appear at all, whereas "J" is occasionally found in place-names, e.g. Sancti Joannis instead of Sancti Ioannis. Except for this the usage was very consistent, e.g. the original renderings of such words as Orizava, civitas, vulcano, cujete [a specific epithet], clivis, and Jamaica, were Orizaua, ciuitas, uulcano, cuiete, cliuis, and Iamaica. Sometimes variant spellings were introduced because the printer or the editor did not interpret Mociño's writing correctly (as in divo for clivo, Guanasuato for Guanaxuato, or in the several printed versions of Parangueo). Some errors were apparently those of Mociño himself (e.g. clibis for clivis). Except for the changes in spelling to make the use of "V" and "J" consistent, the differences between the first and second editions are relatively few; some of these are noted in the gazetteer below.

1. Plantae Novae Hispaniae

Sessé M., & J. M. Mociño. Plantae Novae Hispaniae [published in 8 installments plus 2 parts of index, as appendices to La Naturaleza, ser. II, vol. 1]. pp. i–xiii, 1–184, index. 1887–1891. Second edition, revised and reset, pp. i–vii, 1–175, index. México, 1893.

This work treats approximately 1400 species, of which more than 700 are credited to earlier authors, and the remainder described as new. The evidence all suggests that it was intended as a unit—if not for publication, at least for an interim report on the work of the *Expedición Botánica* -that it was chiefly if not entirely the work of Mociño; and that it was completed while the Expedition was stopping in Guadalajara in the Spring of 1791, and forwarded to the Viceroy in July of that year.

Sessé had written to the Viceroy, Revilla Gigedo, on 16 Aug 1790, as the Expedition passed through Morelia (AGH 527^{12}: 35–36). In an effort to revive the flagging spirits of some of the members of the party, he asked the Viceroy to approve a plan to divide responsibilities among the group, and to give each individual some particular task; his thought was that petty jealousies might thus be eliminated, and the results of the several workers' observations might be combined later into a general report: "Esta constancia del merito de cada uno hara que todos se empeñen con el maior teson, y que nadie viva con recelo de que otro puede usurparle la gloria que la corresponde." Sessé added that he knew he had the authority himself to set up such a scheme, but he thought the orders would be more effective coming from the Viceroy! The plan was officially approved in January 1791.

Sessé wrote again to the Viceroy, from Guadalajara on 22 Jul 1791 (AGH 464^{5}: 1–2), announcing the dispatch of a large manuscript with descriptions and paintings: "por el correo dirijo a V.E. un caxon con dos tomos de manuscritos en folio, y los Dibujos de las producciones mas raras que se han observado en la ultima excursion." A few weeks later, having reached Tepic, Sessé wrote to the king's minister in Spain that on the 22nd of July he had dispatched to the Viceroy a box with the descriptions of 1383 plants in two volumes in folio, and the "Drawings which are expressed in the attached Catalogue" (Sessé to Marqués de Bajamar, Tepic, 13 Aug 1791, quoted by Wilson, p. 63). The entire shipment reached Cádiz in the spring of the following year (1792), and came eventually to the notice of the King (Wilson, pp. 67–68).

The "Dibujos" mentioned by Sessé in his letter of 22 Jul 1791, depicting as he stated the rarities that had been observed "in the last excursion," evidently comprised a duplicate set of the *Icones* made by the artists of the Expedition during the trip from Mexico to Guadalajara; the greater part of the set remains in Madrid, in the archives of the Instituto Botánico. A list of all the plates sent to Madrid in 1791, in Mociño's hand, is also available at Madrid. An enumeration of the paintings in the Madrid set was published by José Ramírez (An. Inst. Méd. Nac. Mex. 6, no. 2: 66–84. 1903).

The text, with its descriptions of the 1383 plants mentioned by Sessé, and the paintings to the number of more than 100, came in due time to the attention of the King; this seems to have been early in 1792 (much of what follows is based on the account given by Arias, pp. 279–281). In 1804 Sessé tried to locate the material, but without success. It was not until 1819 that Mariano Lagasca studied, and prepared an inventory of, a collection that had been in the possession of a Dr. Eugenio Peña, a *Catedrático* at the Colegio de San Carlos, Madrid. The material is now, and presumably has been since Lagasca's time,[1] in the archives of the Instituto Botánico A. J. Cavanilles (División 4, núm. 26). The descriptive text was so well characterized by Lagasca that there can be no doubt it was the manuscript of the *Plantae Novae*

[1] According to José Ramírez (An. Inst. Méd. [México] 6, no. 2: 68. 1903), Lagasca actually received the collection in August, 1813.

Hispaniae. As Arias Divito says, it has never been explained how the material came originally into the possession of Dr. Peña. It remained in the archives of the Instituto Botánico until it was "discovered" and eventually published, with only minor changes, in Mexico.

The manuscript consists of two folio volumes (Vol. 1, pp. [i–viii], 1–554, through *Gesneria maculata*; vol. 2, pp. 1–[502], from *Stemodia siliquosa* to the end, plus the *Index Classium* of 43 pp. and one blank page). Everything, including preface, headings, page-numbers, text, and index, is in Mociño's hand. My supposition is that this was his special project during most or all of the "Third Excursion," that is, from the time the Expedition left Mexico in the spring of 1790, until they left Guadalajara for Tepic in mid-summer of 1791. The circumstances under which the manuscript and the paintings were transmitted to the Viceroy by Sessé at that time, make it clear that the whole was intended in the nature of a report, not for publication. This is explained in Mociño's preface to the work: "Trienni peregrinatione collectas vegetabilium species duobus modo voluminibus sistimus; quas quum difficiles itineris incommodis lassati descripserimus, Auctorum qui per consimiles Americae plagas peragrarunt operibus destituti, non minus et in dictione elegantia et in determinatione desit exactitudo." He says, in effect, that we have assembled in two volumes an account of the plants collected during a trip of three years. Because of the difficulties imposed by travel, and because of the lack of some of the pertinent literature, the account may be wanting in elegance and in exactitude.

Other evidence, both external and internal, seems to be quite consistent. There are indeed two volumes of manuscript as Mociño says, and the "trip of three years" to which he alludes is evidently his way of describing the work of the Expedition, which effectively began early in 1788, almost exactly three years before they reached Guadalajara. Furthermore, the localities cited in the *Plantae Novae Hispaniae* include only those visited by the Expedition up to and including the month of April, 1791; a few species are reported as flowering at Guadalajara in April. Additional records of species from Guadalajara, flowering in May, June and July, are found in the *Flora Mexicana,* as are records of visits to localities further west in Jalisco and Nayarit (e.g. Hostotipaquillo, April to July; Tequila, June to July; Paramita, September; Acaponeta, August and October). Except for one or two unidentified localities, all those mentioned in the *Plantae Novae Hispaniae* pertain to the area near Mexico City where the Expedition worked in 1787–1788; to the transect from Cuernavaca to Acapulco, along which the Expedition worked in 1789; or to the route from Mexico to Guadalajara, along which the "Third Excursion" took place in 1790–1791. It is a clear inference that the manuscript was completed and copied by Mociño, between the time he reached Guadalajara in March or April of 1791, and the time he left for Tepic with the Expedition, perhaps early in August the same year. The circumscription of the manuscript cannot readily be explained in any other way; if Mociño had written it at some later time–the earliest possible time would seem to have been after his return from Nootka in 1793–then it is hard to see why he should have omitted all the plants collected in the fall and winter of 1791–1792, and also all the plants collected by Sessé in the State of Mexico and in Hidalgo in 1792. These later collections are all cited in the *Flora Mexicana*; the only satisfactory explanation seems to be that the descriptions were written after the completion of the manuscript of the *Plantae Novae Hispaniae* and later–more or less by chance–collected in the volumes that were published under the name of *Flora Mexicana.*

Plantae Novae Hispaniae is a conservative work. Mociño says in the preface that they are not going to describe any new genera, and that many plants need further study before their systematic position can be established. This last was, naturally, a marvel of understatement. Be it remembered that Sessé and Mociño were attempting to identify Mexican plants with the aid of the works of Linnaeus and other European

authors. The European literature of the 18th Century contained very little useful information about tropical American plants, and it is much to the credit of Sessé and Mociño that they succeeded as well as they did in assigning hundreds of new species and genera to a place in the Linnaean system. In a large majority of cases, their identifications were reasonable ones on the basis of the literature available to them. Study of the published descriptions, the *Icones,* and the names assigned by them to herbarium specimens, shows that at the family level they rarely erred in assigning an unknown species; this is to say that although they did not make use of family names or even family groupings, they ordinarily managed to assign an unknown to the correct genus or to a genus taxonomically close enough to be confused. Only occasionally did they blunder egregiously, as in identifying *Nama jamaicensis* with *Gentiana saxosa.* Their most difficult problems arose at the generic level in such families as Acanthaceae, in which generic limits were poorly understood at the time; they assigned almost all the members of this family, for example, either to *Dianthera,* to *Justicia,* or to *Ruellia.* At the specific level there is a tendency in the *Plantae Novae Hispaniae* to recognize one or more Linnaean species in a familiar genus, before attempting to separate out the indigenous Mexican species, if any. In *Galium,* for example, the authors recognize but two species, both presumably indigenous to Mexico, but listed without question as *Galium boreale* L., and *G. aparine* L. In *Valeriana* only the last species, *V. ramosa,* is described as new from Mexican material; the first six species, even though supposed by the writers to be natives of Mexico, are all identified with Linnaean names applied originally to Old World species.[1]

The arrangement of the flora is according to the Linnaean system. The arrangement of genera within classes and orders likewise follows closely the arrangement in the *Species Plantarum.* The species within each genus are arranged so as to begin with those described by earlier authors; the newly described species follow. Each species is provided with a carefully constructed contrasting character of a few words, in the Linnaean manner. In the genus *Eugenia,* for example, the sequence is as follows:

Cotinifolia [Jacq.] Eugenia foliis ovatis obtusis integerrimis, pedunculis unifloris.
triflora [Sp.Nov.] Eugenia foliis ovali-lanceolatis, integerrimis, pedunculis terminalibus trifloris.
conglobata [Sp.Nov.] Eugenia foliis ovato-oblongis, integerrimis, subtus tomentosis, floribus axillaribus conglobatis.

Here there are two sets of contrasting characters, in leaves and inflorescences, together ample for identification of any one of the species -in the fortunate chance that no other species with similar leaves or inflorescence happens to turn up! The multiplicity of species in many tropical genera, never fully demonstrated during the heyday of the Linnaean system, was one of the factors that led to the abandonment of that system; the useful method of giving a species a name of a few words that served at the same time as a marker and as a means of identification, was no longer useful when discovery of numerous new species forced these phrase-names, or "characters" into obsolescence almost as soon as they were published. Mociño noted in his preface that they had attempted to retain the classical differentiating characters of species as far as possible, but for the sake of clarity and for the convenience of botanists of the future, they sometimes found it necessary to make changes in the characters.

The treatments of individual species in the *Plantae Novae Hispaniae* begin with the trivial name, the character, and appropriate synonymy (consisting of citation of Linnaean and other literature); this is usually followed by some original description in

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[1]On the other hand, Sessé & Mociño were not reluctant to recognize novelties in the Mexican flora. In the list of 187 paintings made during the "First Excursion" of 1787–1788, about a third of the species were indicated as new, by the addition of the letter N to the Latin binomial. This was explained in the title of the list of paintings: "Index plantarum quae iconibus demonstrantur litera N novas indicat."

addition to the character, by a statement of locality, habitat and season of flowering, duration of the plant (whether annual or perennial, etc.) and sometimes by comments on vernacular names, medicinal uses, etc. Although the same plan of presentation is followed throughout, the modern user may be confused by seeming inconsistencies. Monotypic genera, for example, as in Linnaean usage, are treated with no formal character, as none is needed to distinguish one species from another. New species are usually more or less adequately described by Sessé and Mociño, but occasionally one is differentiated by the character alone; the only entry for *Verbena integrifolia,* for example, is "Verbena tetrandra spicis filiformibus; foliis oblongo-elipticis, integerrimis. Fl. Mex." This is in obvious contrast to a group of species treated in the works of Linnaeus under "Verbena tetrandra, spicis filiformibus . . ." but with leaves serrate, laciniate or bipinnatifid.

The original descriptions in the *Plantae Novae Hispaniae* are for the most part carefully drawn. Apparently it was the practice of the *Expedición Botánica,* wherever a new species was encountered in the field, to draw up a description at once. Many descriptions refer to flowers or fruits but not both; in some instances the authors note that they have seen no more than the one stage. By the time of compilation of the manuscript of the *Plantae Novae Hispaniae* there had been little opportunity for the botanists of the Expedition to make careful comparisons at the specific level throughout the vast territory they were surveying, and it is pretty clear that descriptions often refer to a single plant or a single population from the cited locality. Well-known species (for example, "Achras zapota" and "Prunus virginiana," both common in Mexico as cultivated or semi-wild plants) are usually described no better than the rare ones, except that both flowers and fruit may be mentioned. Introduced species and weeds are treated with no description at all, or often with remarks on uses and especially on medicinal properties. Sometimes a short description is necessary if it seems to the authors that the Mexican plant they are describing differs in some way from that described by Linnaeus or some other author.

The statements concerning habitat and flowering season are usually self-explanatory once the reader has become familiar with the geographic names. The authors made an effort to cite localities and dates for each species, even weeds and cultivated plants, and this is often helpful in determining something about the identity of a given species. For example, *Fragaria vesca* is said to grow "in Europa ac plerisque Novae Hispaniae hortis," but *Myrtus communis* "in Asia, Africa, plurimisque Europae provinciis et in temperatis Temascaltepec et Sultepeci montibus." The implication is that the *Fragaria* is a cultivated plant, but the *Myrtus* is some (mistakenly identified) wild plant in the mountains of the State of Mexico. For species of Linnaeus and other authors, it was Mociño's practice to cite not only the localities known to him personally, but also those cited by the earlier author. Thus for *Boerhaavia erecta* the entry is "Habitat Veracruce et oppido Apatzingan," and for *Boerhaavia scandens* "Habitat in Jamaica, in oppido Apatzingan et in civitate S. Jacobi de la Vega." As these are both Linnaean species, the clue is to be found in the *Species Plantarum,* where the locality for *Boerhaavia erecta* is given as "in Vera Cruce," and that for *B. scandens* as "in Jamaica *ad urbem jago de la vega.*" Apparently there are no references in the *Plantae Novae Hispaniae* to collections made at Veracruz by the *Expedición Botánica*; although the Spanish members of the expedition entered Mexico by this port, they seem not to have collected plants there until the later years of the project, and even then sparingly.

The citation of non-Mexican localities affords one way of identifying Linnaean species in the *Plantae Novae Hispaniae,* even in the occasional instances in which the synonymy is not given and the species superficially appears to be described for the first time by Sessé and Mociño. *Convolvulus muricatus,* for example, is treated without any reference to Linnaeus or to any previous literature. The locality is given as

"Habitat Quahunahuacae et Tecontlapani audit, et in Surate." As the locality for *Convolvulus muricatus* L. (Mant. 1: 44. 1767) is given as "Habitat in Suratte," it is clear that Sessé and Mociño were aware of this Linnaean name. Additional confirmation is given by the character of *Convolvulus muricatus* as printed in the *Plantae Novae Hispaniae*; except for the removal of a conjunction, it is identical with that in the Mantissa. There is no doubt that Sessé and Mociño were knowingly employing a Linnaean name, even though they failed to cite its author.

It may not always be understood by foreigners that the word "Mexico," as used by Sessé and Mociño, normally refers to the City of Mexico, not to the country as a whole, which they called "Nova Hispania" or, in Spanish, "Nueva España." Thus such expressions as "Habitat Mexici," "prope Mexicum," "in montibus Mexico vicinis," "Mexici circuitibus," "in Mexicanis hortis," "in Mexicanorum Aquaeductum marginibus," etc., refer almost without exception to the one locality. Mexico City was much smaller in 1790 than it is today, and such localities as Tacubaya, the hill of Chapultepec, and San Angel, usually cited in the *Plantae Novae Hispaniae* as "near Mexico," are now well within the urban area.

The month of flowering, as cited for most species in the *Plantae Novae Hispaniae,* usually indicates the month in which the description of the plant was written, and hence the month in which the Expedition visited the locality in question. In a few instance the writers definitely state that flowering had passed by the time of their visit, and they had estimated it on the basis of the condition of the plant when they saw it. Probably other dates were arrived at in this way also, so that any specific record of flowering time may be unreliable. Brand (1960), as pointed out elsewhere, discussed the route of the "Third Excursion" (1790–1791), and showed that by correlation of cited dates and localities in the *Plantae Novae Hispaniae* and the *Flora Mexicana,* it is possible to reconstruct the itinerary with some accuracy.

Mociño, presumably with the advice and agreement of Sessé, went to some lengths to be sure that numbers assigned to the relevant *icones* were cited in the manuscript. He assigned numbers from 1 to 446 to the entire series of plates made by the artists up to the time of writing in 1791. He entered the plate-numbers in the manuscript, apparently after the completion of the rest of the text. When the manuscript was printed, a different format was adopted, which made it necessary to transfer the plate-numbers to a different place in the sequence, and in this process about 65 of the numbers were overlooked and omitted from the printed version, or miscopied.

By far the majority of the plants treated in this work can be assigned to modern genera and species with some confidence. The geographical sources of the materials are well known; almost two thirds of the species were described from the highlands within 50 to 75 kilometers from Mexico City, and the rest came mostly from the mountains of Guerrero or from those of Michoacán, two highland areas that in recent years have been subjected to much floristic study. About 400 of the species treated in the *Plantae Novae Hispaniae* are represented by original colored paintings (or in a few instances copies of these plates); in very many instances it is possible to recognize a species at once from the painting. Specimens in the original Sessé and Mociño herbarium, at Madrid, and in the several duplicate sets that were distributed by Pavón, often bear the same epithets that were ultimately published in the flora; with some knowledge of the geographical source of the specimens it is not difficult to match specimens and descriptions, even when no painting is available.

There remains a residue of approximately 700 species that were not thought to be new, or thought to be so well known that neither illustration nor long description was necessary for their recognition. Some of these are not represented by specimens in the herbarium, and their identities are conjectural. Such plants as *Canna, Olea europea, Rosmarinus officinalis, Plantago major, Nicotiana tabacum, Pastinaca sativa, Dianthus*

armeria, and *Amygdalus persica* have to be taken on faith. Presumably Sessé and Mociño (or at least Cervantes and others who had learned their botany in Spain), knew the common European weeds and the important crop plants and ornamentals. Even for native Mexican plants their generic assignments were very good considering the state of knowledge at the time they were working. If one of their species happened to have been known to Linnaeus, they often arrived at the correct name for it (e.g. *Maranta arundinacea, Boerhaavia erecta* and *B. scandens, Tamarindus indica, Allionia incarnata, Scoparia dulcis, Mirabilis jalapa, Heliotropium curassavicum, Anagallis arvensis, Convolvulus (Merremia) quinquefolius, Tillandsia usneoides, Paullinia pinnata, Rhizophora mangle, Trichilia hirta, Bixa orellana, Waltheria americana,* etc.). The most noticeable weakness of their flora is their tendency to equate Mexican species with those already described by Linnaeus, Jacquin, Miller and others. As Sprague long ago pointed out, they were working before the birth of the science of phytogeography, and at first it did not seem strange to them to find African, Asian, and European species in Mexico. It is clear, however, from the name-changes they made in the herbarium and on the paintings, that as time went on they gradually came to realize how large a proportion of the Mexican flora was undescribed in the literature available to them. It would have been interesting indeed to see what Mociño's conclusions on species-limits would have been if he could have re-written the *Plantae Novae Hispaniae* after an interval of more than a decade in the field.

2. **Flora Mexicana**

Sessé, M., & J. M. Mociño. Flora Mexicana [published in 9 installments including index, as appendices to La Naturaleza, ser. II, vol. 2]. pp. i–xi, 1–263, index. 1891–1897. Second edition, revised and reset, pp. i–xi, 1–240, indices. México, post 30 Sep 1894, i.e. between pp. 48 and 49 of edition 1.

This work does not form a unit like *Plantae Novae Hispaniae*; it consists of descriptions of (or merely brief references to) almost 1500 miscellaneous species. The value of the *Flora Mexicana* lies in the descriptions that were published for the first time in that work, i.e. somewhat fewer than half of the total. In order to use the work intelligently, the reader must understand the source of the materials that went into it.

The manuscript of the *Flora Mexicana,* now in the archives of the Instituto Botánico at Madrid, consists of approximately 1000 unnumbered leaves, bound in parchment in three folio volumes. There is no title-page or introduction, the name "Flora Mexicana" evidently having been supplied by the editors of the printed version. The leaves making up the three volumes comprise a miscellaneous assortment on different papers, in different handwritings; leaves may be out of order, or bound on the wrong margins.

The first eight pages (including the genera *Amomum, Costus, Maranta,* and *Alpinia* through *bicalyculata* of the printed text), are in the hand of Mociño, evidently intended as the beginning of a new inclusive flora in the style of the *Plantae Novae Hispaniae.* This part of the text includes references to *Icones* and herbarium numbers that seem to have been assigned (probably in Madrid) after the final organization and enumeration of the collections and the paintings. The highest numbers cited are "Ic.7," and "Herb.7." Species from Puerto Rico and from the lowlands of eastern Mexico are included, so it is evident that Mociño had studied the materials collected in the later years of the Expedition.

Beginning with the 9th page the manuscript ceases to be an organized flora; from that point on it consists of a series of plant-descriptions and notes assembled roughly in systematic order, but from a variety of sources.

In spite of the seeming disorganization of the whole, it seems likely that it may

have been bound into volumes at an early date, probably soon after its arrival in Spain. Annotations by Sessé (who died in 1808) are frequent in the first volume, but almost no corrections in his hand appear in the second and third volumes, although he added many epithets in blank spaces left by the copyists. It would seem that he worked with the manuscript as a unit in the last years of his life.

Mociño also seems to have worked more intensively with the first volume, in which he made a few annotations, including some references to numbers in what was intended to be the final herbarium sequence, e.g. "Herb. 22" (in reference to *Veronica romana*), "Herb. 23" (*V. crenulata*), and "Herb. 21" (*V. beccabunga*).[1] Mociño's part in writing the first eight pages of the revised manuscript has already been mentioned.

Although the sheets of the manuscript *Flora Mexicana* are bound into volumes, they do not form a connected whole but a collection of individual pages. Thus although for convenience one may refer to the "right-hand" or "left-hand" page as in a printed book, the right-hand page is essentially the page on which an individual description was written, and if this is long enough to be continued on the back of the paper it occupies a part of the top of the "left-hand" page after the sheets are bound together.

Descriptions of species are usually less than a page in length. Sometimes they are continued onto the back of the sheet. The Linnaean class- and order-numbers are written at the top of most right-hand pages, and also at the top of the following left-hand page when the description runs over. The name of the genus is usually written at the top of the right-hand page following the class-order designation, and is followed by what is presumably a reference to the herbarium of New Spain as it was finally arranged; e.g.

Octandria Trigynia
Paullinia t. 3. f. 196

Many references like the above, which I take to be citations of volume ["t."] and page ["f."] are found in the Sessé & Mociño herbarium as well. All were omitted from the printed version of the *Flora Mexicana.* The exact meaning of the citations I can only surmise; probably the herbarium was in some way arranged in volumes—a common practice until well into the 19th Century. References in the manuscript *Flora Mexicana* to "t. 4" usually pertain to plants of Guatemala or of eastern lowland Mexico, suggesting either that this volume contained Mociño's later collections, or at least the collections from the later years of the Expedition.

In addition to miscellaneous assemblages of unconnected pages like those described above, there are some sections that form a short continuous manuscript written by an amanuensis on both sides of the sheets, these mostly devoted to the species of a particular genus and (except for the rather frequent admixtures of irrelevant material) arranged in some attempt at a Linnaean order.

I cannot explain the selection of materials that went into the manuscript, as on the one hand they represent a part (but by no means all) of the new plants that were found in Mexico, Central America and the West Indies after the compilation of the *Plantae Novae Hispaniae*; on the other hand they duplicate to some extent the descriptions that were included in the *Plantae Novae Hispaniae.* In contrast to the limited number of localities cited in the latter work, and the conservative references to Linnaean and other species, the localities cited in the *Flora Mexicana* are almost entirely those where the authors themselves have collected, and very few references are

[1]These annotations were omitted in the printed version, as were references to names that had been crossed out and replaced in the manuscript.

made to those of earlier authors. Geographical representation of the included species is about as follows:

1) West Indies. About 175 species are cited as from Puerto Rico, and about 100 from Cuba. Many or most of the descriptions in the bound manuscript seem to have been copied from loose single sheets which are scattered among other unbound papers in the archives at Madrid. An exact count has not been made, but probably most of the species described by Sessé during his sojourn in the West Indies are included in the bound copy.

2) Central America. About 14 species are cited. The descriptions are copies of those found in the so-called "Flora of Guatemala," which exists in manuscript in the Madrid archives, and which includes treatments of more than 500 species.

3) Localities already cited in the *Plantae Novae Hispaniae.* About 450 species are treated in the *Flora Mexicana* exactly as in the *Plantae Novae Hispaniae*; that is, the descriptions and comments are identical in the two floras, or differ in details of wording and arrangement. About 150 such species are proposed as new in *Flora Mexicana*; about 300 are attributed to earlier authors. Often the descriptions in the two floras differ in such a way as to make it apparent that one copy has been made from the other, with improvements in the Latin, or formalization of the descriptions. It is probable that the descriptions as they appear in the *Flora Mexicana* represent those actually made in the field (or copies of these), subsequently adapted by Mociño to the formal style of the *Plantae Novae Hispaniae,* the originals then ultimately assembled and bound with others in the manuscript of the *Flora Mexicana.* The 450 species duplicated in the latter work include fewer than a third of all those treated in the *Plantae Novae Hispaniae,* and fewer than a quarter of the new species.

There are in addition, in the *Flora Mexicana,* numerous references to species that might have been treated in the *Plantae Novae Hispaniae,* but were not; that is to say, species from localities visited by the Expedition before the Spring of 1791. There are, for example, some 42 new references to localities in Michoacán, Colima and Jalisco, where the "Third Excursion" travelled in 1790–1791. The new material from southcentral and southwestern Mexico, thus presented in the *Flora Mexicana,* seems to be about one-fourth as much as that originally assembled for the *Plantae Novae Hispaniae.*

4) Localities in Mexico visited by the Expedition after the spring of 1791. The species cited from these localities are divided about as follows:

West and northwest of Guadalajara, 1791–1792	42
Trip to the State of Mexico beyond Toluca, 1792	73
Hidalgo and northern Veracruz (1792)	62
Orizaba–Córdoba region (mostly 1793?)	93
Tabasco and southern Veracruz (1793–1794)	140
Eastern Mexico, various	67

There are some manuscript descriptions in the Madrid archives that are not included in the bound volumes of the *Flora Mexicana,* and so were never published, but (as in the case of the West Indian species) it is probable that these are relatively few.

In summary, the *Flora Mexicana* includes a significant amount of new information about the early Mexican collections made from 1788 to 1791, and probably treats a considerable majority of all the species that were described by the members of the Expedition in Mexico after the Spring of 1791; a comparable majority of the West Indian species for which descriptions were prepared by Sessé; and a very small percentage of the species collected and described by Mociño on his Central American expedition.

Botanists who have used the *Flora Mexicana* have commented upon the many inconsistencies that are so apparent in the printed text; the approximately 85 species

that are listed by generic name only; the numerous species that are listed by the character only, without supplementary description or citation of locality; the fact that certain specific names appear two or three times in the text, often obviously pertaining to different plants. Because of these inconsistencies the impression has become current that the work of Sessé and Mociño may be disregarded, or at least dismissed as of no consequence. A somewhat better evaluation of the book may be made if one attempts to separate the information in the text into two kinds: on the one side the finished descriptions of new species (or sometimes of Linnaean species), and on the other side the incomplete descriptions, the species without names, the obvious duplications. Most of the completed descriptions of species, when accompanied by citation of habitat and locality, were individually prepared, were based on actual specimens observed in the field, and are therefore perfectly valid and reasonably accurate. Actually they are better plant-descriptions than most others of their period; it is only unfortunate that they were delayed a century in publication.

The chaff amid these grains of wheat is not an indication of lack of botanical ability on the part of the authors of the *Flora Mexicana*; it is exactly what one might expect if he published a series of the inchoate field notes and scribblings of any field botanist. *Convolvulus umbellatus,* for example, appears three times in the *Flora Mexicana.* One species (the third) is the same as the *Convolvulus umbellatus* of the *Plantae Novae Hispaniae*; the character is taken verbatim from the *Species Plantarum,* and the description in the *Flora Mexicana* has evidently been modified but slightly for the account in the *Plantae Novae Hispaniae.* Another *Convolvulus umbellatus* is from Puerto Rico and the third from Orizaba, Veracruz; in each instance the character contains the basic words "foliis cordatis, pedunculis umbellatis," but differentiating words have been added to each. It is evident that in describing each species, the author or authors identified it first with the Linnaean *Convolvulus umbellatus,* then began to work out the differences. The duplication in published names does not mean that Sessé and Mociño gave the same name to three species without realizing what they were doing; it means simply that their preliminary notes bearing tentative determinations were published even though they had not completed the work of comparison and differentiation.

Some of the deficiencies of the *Flora Mexicana* may be laid at the door of the editor(s) who prepared the printed version. Admittedly they had a difficult task, but it was not very critically done. In the large genus *Salvia,* for example, there are descriptions of 44 species. The first 33 are in the hand of a copyist; the last 11 are apparently in the hand of Sessé and, except for the last two, duplicate a corresponding number of the copied ones. In the printed version (in which the order of species bears no relation to that in the manuscript), duplication of descriptions has been avoided except that in the printed text one species appears under two different names (*parvifolia* and *microphylla*). This came about because the third species in the manuscript (description by a copyist), originally labelled "parvifolia" was changed by Sessé to "microphylla"; this was published as the 30th species of the printed text, whereas the 35th species of the manuscript (the same description, written by Sessé), labelled "parvifolia" and never changed to "microphylla," was published as the first species of the printed text, "parvifolia." The editors also:

1) Omitted the whole text of two species in the manuscript, presumably because one was very short and the other had a wavy line drawn across it.

2) Supplied the epithet "coccinea" to go with the manuscript description of an unnamed plant following the treatment of *hirsuta*; this epithet was presumably taken from the *Plantae Novae Hispaniae* by the editors.

3) Where Sessé had changed an epithet from *bicolor* to *discolor,* the editors changed it back to *bicolor*; where Sessé changed *hians* to *discolor,* it was printed as *discolor.*

4) Failed to mention or suppressed Sessé's annotations in seven species.

5) Suppressed manuscript references to herbarium specimens, icones, and designations as new species in five instances.

6) Modified the spelling of a place name in one species.

In short, in the attempt to make a coherent whole from a manuscript never intended for publication, the editors often introduced additional inconsistencies.

Linnaean species and those of other authors, when treated in the *Flora Mexicana,* are usually not identified as such (as they mostly are in the *Plantae Novae Hispaniae*) by the citation of the pertinent literature, nor by the mention of the original localities.

Presumably such citations would have been copied into the final draft of a manuscript like that of the *Plantae Novae Hispaniae.* In the *Flora Mexicana* it is sometimes impossible definitely to decide whether a given name is derived from Linnaeus, or is intended as new. When the character is taken directly from Linnaeus, as it sometimes is, or when the specific epithet is a distinctive one [e.g. *Bucida buceras* or *Guarea* "trichiloides"], it can hardly be supposed that a new name was intended. On the other hand, such names as *Epidendrum ensifolium, Epidendrum guttatum,* or *Epidendrum* "retussum," although probably based on the work of Linnaeus, might have arisen through coincidence. Probably most or essentially all of the names in the *Flora Mexicana* that seem to be homonyms of Linnaean names, were actually not intended as new; Sessé and Mociño were thoroughly familiar with the works of Linnaeus, and it is unlikely that they would have used his specific epithets for new species of their own, except perhaps through an occasional oversight.

EXCURSIONS AND TRAVELS

In any study of the collections made by Sessé and Mociño and their associates, it must be kept in mind that casual collecting was held to a minimum. Travel was difficult and slow in the New Spain of 1787. In order to collect a large number of plants at a locality anywhere outside the Valley of Mexico, it was necessary to mount a full-scale field-trip lasting days, weeks or even months. Such trips were planned to reach as many different areas as possible. Sometimes more than one trip could be carried out during the growing season; others lasted a year or more. Most of the collections for the proposed *Flora Mexicana* seem to have been made in the course of these long excursions in which several or most of the members of the Expedition took part. At the time of collection, descriptions of individual species were drawn up according to a formalized and highly technical procedure designed to fit each plant into the Linnaean system. Presumably each description took a fair amount of time to write even after the laborious process of flower-dissection had been completed. During the same time, the artists made sketches and paintings of the species new to the botanists, or of previously known species if these had not been found in good condition before. Because of the time involved in preparing descriptions and drawings of all novelties, relatively few species (at most a few hundred) might be studied carefully even over a long trip like that of 1790–1792.

The botanists of the expedition thus seem to have proceeded in a fashion quite unlike that of the modern student of a new flora, who tends to collect widely, indiscriminately, and in volume, then return to base to study his materials and eventually to report upon them after prolonged periods in the herbarium and library. As nearly as I can express it, Sessé and Mociño seem to have written their flora as they went along, making their identifications with the aid of the library and manuscripts they carried in the field, collecting little or nothing that was not directly relevant to the flora, and essentially disregarding all the species they had noted and described or illustrated on excursions in previous years.

Because they worked in this way, Mociño was able to complete the manuscript of the *Plantae Novae Hispaniae* within a few months after the expedition arrived in Guadalajara in the spring of 1791, so that a copy could be sent off to the Viceroy in early summer as a record of the work of the last three years, including the species described from two earlier excursions and also those described along the route between Mexico and the West.

The members of the Expedition thought of their work in terms of "excursions," and it seems convenient to list here the activities classified in this way, then to discuss them in more detail below.

The so-called "First Excursion," which lasted from August, 1787, through the year 1788, was hardly an excursion in the modern sense. It included some collecting near Mexico City, a trip to Toluca, various shorter trips within the Valley of Mexico, establishment of a base at San Angel and another at San Agustín de las Cuevas and exploration of the nearly mountains, a trip of a month or more to Yecapixtla and from there by way of Amecameca to the *tierra templada.* In the course of the "First Excursion" the botanists collected between 550 and 600 species of plants, and the artists made paintings of 187 species.

The "Second Excursion," from March through the end of December, 1789, was from Mexico to Acapulco, with intermediate stops in Cuernavaca, Chilpancingo, and other places in the uplands of Guerrero. In the course of the season the botanists collected material of about 372 new or otherwise interesting plants, and the artists made about 180 new paintings.

The "Third Excursion," the most ambitious undertaking carried out by the Expedition as a whole, lasted from May, 1790, through the following year, and took the botanists and artists from Mexico to the Pacific Coast in Michoacán, Nayarit, and as far north as Sonora. Mociño and one of the artists, Echeverría, left the party and joined another Spanish expedition that spent the summer and fall of 1792 on a voyage to Nootka Island, while Sessé and the others returned to Mexico in the spring of 1792.

On the excursion of 1790–91 the botanists and artists assembled slightly more than 100 new paintings, and 172 herbarium collections. The number of plants and paintings obtained in the course of the Nootka trip is unknown, but was considerable.

The "Naturalist" of the Expedition, Longinos Martínez, did not accompany the rest on the "Third Excursion," but left Mexico early in 1791, crossed the continent to San Blas, Nayarit, worked in southern Nayarit for the rest of the year, then crossed to Cabo San Lucas, whence he made his way overland to Alta California. He returned to San Blas in November, 1792, and afterward worked along the coast to the southward for more than a year, returning to Mexico in January, 1794.

After the "Third Excursion" there were no more such formal forays in which the expedition took part as a whole. The following were never officially designated as "Excursions":

1. In 1792, between July and December, Sessé travelled and collected in the State of México, then in Hidalgo, Puebla, and Veracruz.

2. In 1793, from July until the end of the year, Sessé made his headquarters in Puebla and Orizaba, accompanied by Echeverría.

Mociño, having returned from the Pacific Northwest about the first of April, 1793, seems to have spent the summer and autumn of that year, and most of the year 1794, on the Atlantic slope in Veracruz, Oaxaca, and Tabasco.

3. From April, 1795, through March, 1798, Sessé was occupied with a trip to Cuba and Puerto Rico. He was accompanied by Echeverría. I have found no precise record of their accomplishments in the Antilles, but apparently they were only moderately successful in Cuba, whereas in Puerto Rico they collected and described at least 180 species that are cited in the *Flora Mexicana.* According to Sessé, they described and drew nearly 300 plants by March, 1797.

4. Mociño, with the artist Cerda, left Mexico in June, 1795, and travelled by way of Puebla and Oaxaca to Guatemala, which they reached in August or September, 1796. They were in San Salvador in March, 1797, and in León, Nicaragua, two months later. They left Nicaragua on the return trip about the beginning of the year 1798, and reached Mexico about the end of that year.

Longinos Martínez left Mexico soon after Mociño's departure, and travelled by a different route to Guatemala. He reached the capital city, probably early in June, 1796, and remained there for some years, never again establishing effective communication with the rest of the Expedition.

The First Excursion, 1787–1788

After the formal commencement of the Expedition, in Mexico City in August, 1787, all activities seem to have been concentrated in the Valley of Mexico for some months. Sessé and Cervantes were occupied with the foundation of the new Botanical

Garden. The biologists and artists found themselves in a new environment. The botanists were located in a moderately large city situated on a poorly drained plain, surrounded on all sides, at a distance of a few miles, by high mountains. San Angel was a town two leagues from the city, not as it is today a few minutes by taxi from the Zocalo. A journey to Toluca, now less than an hour by a good highway, then meant a round trip of several days if pack-animals were employed to carry the botanical equipment. Because of the slowness of travel in the mountains, and the difficulties attendant upon the transportation of collecting equipment and the equipment for the artists, the regular practice seems to have been to move the Expedition to one after another of a series of temporary bases where botanists and painters could work until the area was exhausted. As a result of this, the localities cited in the *Plantae Novae Hispaniae* are relatively few in number; those from the Valley of Mexico, for example, include Mexico [City] itself (many citations); San Angel (more than 60); San Agustín (about 23); the "Santo Desierto" of the Carmelite Fathers [now Desierto de los Leones] (about 12); and less frequently cited places including Coyoacán, Ixtapalapa and Tepelpa (5–7 each).

The first planned trip of which I have definite knowledge was to Toluca in mid-December, 1787. The botanists, accompanied by a painter, visited this place for the purpose of describing the "arbol de las manitas," a tree known since the time of Hernández, but of which in 1787 only one individual had been located, and that a cultivated specimen in Toluca. Cuttings of this tree were carried to Mexico; one finally became established, and bore fruit in 1795. The trip to Toluca is mentioned by Sessé (in a letter to Ortega, 5 Jan 1788, quoted by Alvarez López (1952, pp. 50–51). It was the subject of a "dissertation" by Cervantes, this abstracted at length by Cavanilles (An. Ci. Nat. Madrid 6: 303–314. 1803; reprinted in Naturaleza 7: app. 33–38. 1884). Oddly enough there is no account of the hand-tree, *Chirostemon* (or *Chirantho-dendron*) in the *Plantae Novae Hispaniae* or the *Flora Mexicana.*

By the beginning of May, 1788, a good beginning had been made on the botanical work in the vicinity of the Capital. According to a statement on May 8 (AGH 462[1]: 7) there were already 200 plants in the herbarium, and as many paintings. Longinos, Senseve, and Sessé, with the artists, had already visited "la ciudad de Toluca, Desierto de los Carmelitos en el Pueblo de S^{n} Angel, y la de los Montes del Santuario de N^{ra} Srā de los Remedios" (Sessé, in AGH 462[1]: 8–9, 7 May 1788).

On June 12 the Expedition established itself at San Angel, there to stay some weeks exploring the vicinity, particularly the mountains to the south and southwest (Sessé to Ortega, San Angel, 26 Jun 1788, quoted by Alvarez López (1952, p. 51). I suspect that after completion of work near San Angel, the base was moved to San Agustín de las Cuevas [now Tlalpan], a little farther south along the edge of the mountains. In the *Plantae Novae Hispaniae,* for example, of the more than 60 species cited from San Angel, 8 are said to flower in June, 20 in July, 22 in August and 8 in September. The presumption is that the botanists worked most actively at this locality in July and August. Species flowering at San Agustin, on the other hand, are concentrated in September (1 in July; 3 in August; 14 in September; 1 each in October and November).

Late in October (27 Oct 1788; AGH 460: 133) Sessé wrote the Viceroy that plants were getting scarce near Mexico, and he planned a longer excursion: "ha resuelto pasar a las tierras templadas de Yacapixtla, Xochistlan y contornos." For this he needed help in getting local assistance: "Asi mismo necesita una Orden de V.E. parque los Justicias y Curas de los Pueblos reciban, custodien, y remitan con las precauciones que se les prevendra, los Herbarios, esqueletos, plantas vivas, Dibujos, esqueletos y Animales disecados. . . ."

Apparently the Expedition moved to Yecapixtla as planned, about the first of

November. Sessé wrote Ortega (5 Jan 1789, quoted by Wilson, p. 30) that they had spent the month of November there and collected a large number of plants (about 27 species from "Ayacapixtla" are cited in the *Plantae Novae Hispaniae*; 7 are said to flower in October, and 10 in November, the others earlier). At the end of November so few plants remained even in the "climas templadas" of Yecapixtla that the Expedition returned to Mexico on December 1 (Sessé, 2 Dec 1788; AGH 460: 136). The party at this time presumably included Castillo, who had reached Mexico from Puerto Rico on 17 July (Sessé to Ortega, 27 Oct 1788, quoted by Wilson, 1962, p. 29), but Longinos and Echeverría, who had remained in "Mexicalsingo"[1] to collect and paint birds, expecting to return to Mexico the 7th of December (AGH 460: 136).

It was presumably on this trip to Yecapixtla that the botanists visited Xochitlán, Amecameca and its "Sacro Monte," and Chichipilco ["inter Amecameca et Ayacapixtla"]. About 50 species in all, mostly late-flowering, are recorded in the floras from these places. One of the most convenient ways out of the high valley of Mexico, the "tierra fría," into the "tierra templada" was to the southeast through Chalco to Amecameca, thence down the valley into what is now the State of Morelos; in more recent times a railroad has followed the same route. In November of the following year (1789), rare plants from Yecapixtla, Xochitlán and Chichipilco were brought into Mexico to form a part of the examination given to the students in the "Exercicios Botánicos" at the Botanical Garden (a note by Mociño; AGH 464[1]: 22–23). This was the occasion on which Mociño won a prize at the graduating exercises. He records also that in 1788 the cost of bringing in plants from the "tierra templada" for the examinations was 19 pesos and 6 reales.

In the field work in 1788, therefore, the Expedition seems to have spent most of its time in the mountains and foothills to the south and southeast of Mexico City, chiefly along a transect extending from San Angel through San Agustín de las Cuevas as far as Amecameca in the present State of Mexico, and Yecapixtla, Morelos. I do not know when, or how many times, the botanists visited the "Eremus Sanctus," a locality cited a dozen or more times in the *Plantae Novae Hispaniae*. Most of the species from this locality are said to have flowered in November or December. Perhaps some of the members of the expedition made a side trip here in the course of the expedition to Toluca in December 1787. A Carmelite monastery had long been located in these high wooded mountains—the region now known as the Desierto de los Leones, then as now not far off the main highway to Toluca from Mexico—and for at least 150 years the area had been readily accessible from Mexico.[2] Perhaps the locality was visited on more than one occasion. Certainly there is no dearth of botanical material there!

Early in January (Sessé, letter to Ortega, 5 Jan 1789, quoted by Wilson, pp. 30–31) the expedition had collected a total of 550 species of plants, these chiefly from the mountains ("without counting the more common ones found in the irrigated lands in the proximities of this Capital"). Between field seasons the botanists occupied their time arranging the plants and paintings in systematic order, following the Linnaean system as taken from Palau's *Parte Práctica de Botánica del Caballero Carlos*

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[1]This is the Mexicalzingo a little west or southwest of Ixtapalapa, well within the present city limits of Mexico, not the better known place in the State of Mexico.

[2]cf. Gage (1958). About 1625, according to Gage, this was the "pleasantest place of all that are about Mexico, called La Soledad, and by others *el desierto*." After describing the "cloister" and the activities of the hermits, he goes on to say, "It is wonderful to see the strange devices of fountains of water which are about the gardens; but much more strange and wonderful to see the resort of coaches, and gallants, and ladies and citizens of Mexico thither, to walk and make merry in those desert pleasures, and to see those whom they look upon as living saints, . . . to cherish them in their desert conflicts with Satan."

Linneo (Madrid, 1784–1788).[1] The resulting arrangement is summarized in a manuscript now in the Instituto Botánico at Madrid, entitled "Yndex Plantarum primer Excursionis Botanicae ad Mexici Circuitus" (4ª Div., Núm. 16). The entire list of 583 numbered species was published with some annotations by Alvarez López (1953, pp. 57–97). About 175 species were supposed by the authors of the list to be new. Many of the names in the list reproduced by Alvarez López have not been published elsewhere.

The paintings made during the so-called "First Excursion," near Mexico in 1787–1788, numbered 187. A partial list of these, beginning with no. 49, is in the archives of the Instituto Botánico (MA), and the complete list, as published by Arias (1968, p. 387), is in the Museo de Ciencias Naturales, Madrid.

From the point of view of the Director, the botanical work of the Expedition in 1787–1788 had been a success. The nearly 600 species of plants collected and described, and the nearly 200 plates completed in the course of the "First Excursion," together represented a considerable accomplishment. It may be noted that in 1789 and 1790–91 the numbers of species collected and sketched were successively fewer, because plants already known and studied were regarded as of less interest, and usually not recollected. Sometimes new paintings were made, especially when the earlier ones had been based on specimens that were in some way imperfect.

The Second Excursion, 1789

Early in January of 1789, Sessé was already planning a new excursion for the coming year. He wrote to Ortega (5 Jan 1789, as quoted by Alvarez López, 1952, p. 53) that the first base of operation would probably be Cuernavaca. On the 13th of February Sessé, Longinos, Castillo, and Senseve sent a petition to the Fiscal, announcing their intention of directing a trip of exploration toward the South Coast, beginning about the first of March. They asked for a general order permitting them to requisition assistance from local government offices along the way, and such an order was issued on March 11. In accordance with this order, this and most subsequent field-parties collected their salaries, at more or less regular monthly intervals, or whenever they reached a town, from the office of the *Administración de Tabacos.* Each member of the party receiving the advance was required to sign the receipt, which was forwarded by the local administrator to the Fiscal, thence to the Viceroy for approval. Most of the documents relating to these transactions are still preserved in

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[1]Palau y Verdera, Antonio. Parte Práctica de Botánica del Caballero Cárlos Linneo, que comprehende las clases, órdenes, géneros, especies y variedades de las plantas . . . traducida del latin en castellano é ilustrada por Don Antonio Paláu y Verdéra. 1: [8], I–LVI, 796 pp. 1784; 2: 1–918. 1785; 3: 1–801. 1785; 4: 1–914. 1786; 5: 1–788. 1786; 6: 1–925. 1787; 7: 1–927. 1787; 8: [I]–CLXXVIII, 1–"782" [482]. 1788.

Copy examined at the Hunt Botanical Library, where a note states that Palau's work is based on Reichard's 1799–80 edition of Linnaeus' *Systema Plantarum.* In volume 1, p. XXVIII of Palau is the note:

> "Incluyo en esta obra todos los géneros y especies, que in diferentes escritos tiene divulgados y corregidos el mismo Linnéo, sin omitir los de sus Mantissas y del Suplemento que su dignísimo hijo sacó a luz el año de 1781."

The enumeration of species in Palau's work ends with *Hongos* in volume 7. The first seven volumes are faithful translations of the works of Linnaeus, from Latin into Spanish. The eighth volume is a miscellany, including the following:

A translation of a work by A. Gouan; "Conclusiones públicas" reached in the Madrid garden in 1787, under the direction of Palau; additions from the work of Reichard (pp. 20–24); "Anomallas" (pp. 25–40); lists of orders and genera; bibliographies and indices in Latin and Spanish; index to synonyms; index to medicinal plants; "Anotaciones" from Reichard (pp. 445–469); corrections.

Mexico in the *Archivo General,* providing the interested historian with a large amount of incontrovertable documentary evidence as to the whereabouts of each member of the Expedition on a number of occasions. I need cite but one example of the usefulness of these receipts. In the *Flora Mexicana* there are cited about 75 species collected on what must have been a trip of some weeks, probably during the months of July and August, to the Volcano of Toluca, the area around Temascaltepec, and the eastern part of Michoacán. I can find no reference anywhere to such a trip except that on 4 Aug 1792, Sessé, with Castillo and Cerda, received 300 pesos advance in Temascaltepec. As Sessé was still in Mexico on July 20, and the whole party was in Hidalgo on September 2 of the same year, it must be assumed that the trip to the State of Mexico took place mostly in August, 1792.

To return to the "Second Excursion," the group of three botanists and two artists moved to Cuernavaca on March 19 (Sessé to Porlier, Cuernavaca, 24 Mar 1789, quoted by Alvarez López, 1952, pp. 55, 76). The party, which included Sessé, Senseve, Castillo, Cerda, and Echeverría, seems to have spent at least six weeks in this area, as they received their salary at Cuernavaca on April 2 and May 2 (AGH 527^{7}: 4, 7). Longinos was not a member of the party, and perhaps never went with them even as far as Cuernavaca. This "angry and intolerant man," as Rickett calls him, began in 1789 the separation from the rest of the Expedition that was to continue for the rest of his life. In a letter to the Viceroy (AGH 527^{14}: 3, Mexico, 16 May 1789), he asked leave to remain in Mexico, to which he had "returned" because of the grave illness of his wife. Sessé later noted (AGH 527^{14}: 4) that Longinos "usó este de Licencia" from May 16 to September 29 because his wife died. If indeed Longinos went at all to Cuernavaca, he was not there when the others received their salaries in early April and early May. He was in Mexico during most of the summer, as attested by a voluminous file of correspondence between him and the Director (AGH 527, expediente 10, is devoted to this; it is headed "Discordias entre el Director del Jardin Botanico D^{n} Martin Sessé, y el Naturalista D^{n} Josef Longinos."). He was in Mexico at least as late as the 19th of August, when he wrote from that place to Sessé (AGH 527^{10}:9–12). His name does not appear on any of the salary receipts signed by the rest of the party at Chilapa, Guerrero (2 Sep, 2 Oct) or at Cuernavaca (23 Dec). He himself wrote a long letter, probably in 1790 (discussed by Rickett, pp. 46, 47), in which he implies that in 1789 he spent 5 months with the Expedition in Mazatlán, Guerrero, a month in Cuernavaca, and 10 or 12 days in Acapulco. It is unlikely that Longinos spent a month in Cuernavaca without collecting his salary with the rest; it is certain that he was not with the group while they were in Mazatlán. I do not know his whereabouts during the months of October, November and December, and it is of course possible that he joined the group at this time, but there is no evidence of it except his own statement that at Acapulco he "got through three months work in 10 or 12 days . . . because the Director insisted on the presence of everyone in Cuernavaca by a certain date." Sessé himself had returned to Cuernavaca and to Mexico late in November, and the entire party except for Longinos signed a receipt in Cuernavaca on the 23rd of December; if the Naturalist returned to Cuernavaca with the rest, as he himself implied, he did not participate in the salary advance.

The entire group, with the exception of Longinos, moved from Cuernavaca to the Hacienda de Mazatlán sometime before the 2nd of June (AGH 527^{7}: 21), and made their headquarters in the vicinity, in the mountains that surround Chilpancingo, for several months. They were still in Mazatlán on the 24th of June. By the 2nd of July they were at Acahuizotla (in the valley below Mazatlán), where they stayed until the 20th, leaving "por escasarse el travajo en sus contornos" (AGH 527^{7}: 12, 20; 527^{10}: 1). Returning to Mazatlán, they crossed the summit to Chilpancingo, where Sessé was on August 5. The Expedition at this time was planning to leave for Chilapa, to the east of Chilpancingo, on the 12th. Sessé was at Aiahualtempa, near Chilapa, on

August 30; and on September 2 and again on October 2 the two artists and the three botanists (Sessé, Senseve, and Castillo) received their salaries at Chilapa (AGH 527^{10}: 6–8; 527^{9}: 4–6; 527^{7}: 26, 27).

There seems to be no clue to the activities of the group between October 2 and December 23 (when they were in Cuernavaca), except that in the *Plantae Novae Hispaniae* there are about 7 references to species from Acapulco, all said to flower in October or November; and, more importantly, in the archives of the Instituto Botánico at Madrid (4ª Div., núm. 12), there is a notebook of 20 manuscript pages, with a cover by Sessé, "Plantas descritas por Dⁿ Juan del Castillo en el viaje ã Acapulco." This is a list of about 42 species, written up in the hand of Castillo in the form of a *florula* complete with descriptions, citations of synonymy, specific localities and dates of flowering, essentially in the form of the *Plantae Novae Hispaniae.* The list begins with 12 species from Mazatlán (October and November), and continues with 4 from Acahuizotla (November), 24 from Acapulco (October to December), 1 from Cojuca [sic] (November) and 1 from Cuaxiniquilapa [sic] (December).

From Castillo's notebook I infer that the field-party divided sometime in October, Sessé returning to Mexico, and Castillo with one or both of the artists continuing to the coast by the regular road. If Longinos ever joined the Expedition it must have been at this time. Evidently Castillo felt himself responsible for the botanical part of the excursion. His presence at Acapulco is attested by the inclusion in the list of such maritime species as *Conocarpus erecta, C. racemosa, Hippomane mancinella, Rhizophora mangle, Guilandina bonducella, Chrysobalanus Ycaco.* I take it that his "Cojuca" is the place now called Coyuca de Benítez, a short distance northwest of Acapulco. It may be supposed that Castillo and his companions reached Acapulco sometime in November, and left early in December in time to reach Cuernavaca on the 23rd of that month. Most of the species in Castillo's list were included in the manuscript of the *Plantae Novae Hispaniae,* and eventually published, but often without citation of definite localities.

Back in Mexico on the 28th of December (AGH 527^{14}: 1), Sessé wrote Revilla Gigedo that the Expedition had withdrawn from the field on December 24, "por que la estacion ya no presenta Plantas en estado de examen hasta la inmediata Primavera." Thus closed the "Second Excursion," which like the first had been a botanical success. The artists had made about 180 paintings, and the botanists had collected material of about 372 new or otherwise interesting species. The latter are listed from a manuscript at Madrid, by Alvarez López (1953, pp. 98–125).

The Third Excursion, 1790–1792

Plans for a third excursion, which began almost as soon as the Expedition returned to Mexico, involved some necessary changes in staffing. Longinos Martínez in effect refused to accompany the party led by Sessé and insisted upon working independently. Mociño, who had not previously been connected with the Expedition, had been a student in Cervantes' course in Botany at the Garden, from May to November, 1789; he had distinguished himself as a student, and attracted the notice of Sessé. Senseve had turned out to be of mediocre attainments, poorly qualified for the study of Natural History; one entire *expediente* in the *Archivo General* (AGH 527, no. 13: 1–70) is devoted to his case and his eventual dismissal from field duty. On March 24 the Viceroy approved a scheme by which Senseve was to busy himself with dissection in the city, continuing to enjoy his basic salary of 1000 pesos a year; Mociño was to accompany the others on their expeditions and receive the extra 1000 pesos which Senseve forfeited by staying at home (the botanists from the beginning

had received a basic salary of 1000 pesos, and twice as much for time spent in the field) (Rickett, pp. 25, 46).

On 8 May 1790 (AGH 527[7]: 35) Sessé wrote to Revilla Gigedo that "dando VE su permiso," the Expedition would set out for the West on the 17th of that month. Presumably this plan was adhered to strictly, as on the 17th Sessé dictated and signed at Mexico a final letter to the Viceroy. On the 18th, having travelled as far as Tlalnepantla near the northern tip of the present Distrito Federal, he sent back his first report (AGH 460: 267, 273). The party included, in addition to servants and pack-animals, the artists Cerda and Echeverría, and the botanists Sessé, Castillo, and Mociño.

The Expedition travelled by the route that is still the most practical one out of Mexico City to the north, to San Juan del Río and thence to Querétaro. From the citations in the *Plantae Novae Hispaniae* it seems they spent a number of days in that vicinity, as they collected and described more than 15 species of plants. Sessé sent a report to the Viceroy from there on 29 May (AGH 460: 271), and soon thereafter the party must have moved on, as they were in Guanajuato by 20 Jun 1790 (Sessé to Porlier, as quoted by Wilson, p. 56). Their route from Querétaro to Guanajuato took them to the north of the modern highway that crosses the level country of the Bajío; they started off a little north of west, to the Hacienda de Ixtla, just within the modern boundary of Guanajuato; from there the road went northwesterly to San Miguel, thence nearly due west from the hot springs of Atotonilco, via the "mountain road" that passed by San Damián, to Guanajuato. Probably they did not do much botanizing along these roads, as the country is a dry one at best, and this was the driest season.

Probably Guanajuato formed a base of operations for the Expedition for about a month. The botanists and artists drew their pay in that city on July 2, but by the next payday, August 7, they were in Valladolid (now Morelia). About 15 species were described in the *Plantae Novae Hispaniae* from "Santa Rosa near Guanajuato," so an excursion of some days may have been made to this mining region in the hills above Guanajuato, visited also a little more than a decade later by Humboldt and Bonpland. The country must have been still dry at this season, before the onset of the rains. The continuing trip southward from Guanajuato presumably began by the regular road to Morelia, passing Temascatío, and Salamanca; probably passing somewhat to the west of Valle de Santiago, via Parangueo and Puruándiro; turning to the southeast, via Huango and Chucándiro near the west end of Lake Cuitzeo, then coming into Valladolid through Tarímbaro from the north. All these places are mentioned in the *Plantae Novae Hispaniae,* but the dates when the Expedition passed through them can be stated in a general way only. Eight species, for example, are cited from the "mountains of Puruandiro," and all are said to flower in July, suggesting it was not yet August when the botanists passed through.[1]

Sessé wrote to Revilla Gigedo from Valladolid on 16 Aug (AGH 527[12]: 35–36), mentioning their arrival on the 8th [this seems to have been an error, as the signed salary receipt is dated the 7th]. He felt that the excursion up to this point had been something less than a success because they had met relatively few species that the botanists had not already studied and described in previous years ["Son pocas de plantas raras q[e] se han visto en esta excursion por la mucha analogia de los montes transitados, y los reconocidos en los años anteriores."]

Probably the botanists were not very active during their stay at Valladolid, as the

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[1]Humboldt followed a slightly different route from Guanajuato to Morelia, going by way of Valle de Santiago and Parangueo (which Kunth transcribed as "Palangeo"), then passing the west end of the Lago de Yuriria at what he called the "Puerto de Andaracuas" and proceeding more or less directly southward to Lake Cuitzeo and Morelia. This was long the regular road between Guanajuato and Morelia; see for example, Alvarez & Durán (1856, p. 30). In 1856 travellers on this highway crossed Lake Cuitzeo in a "canoa."

published floras include no more than one or two references to plants from there. The city lies in a broad cultivated valley and the surrounding mountains, although high and wooded, are hardly spectacular enough to stimulate the party to any special excursions. In any event the next definite date we have for the Expedition is 8 Sep 1790, when the botanists and artists drew their salary at Pátzcuaro. (AGH 527[7]: 53).

For the next few weeks the party worked in the pine-forests of the mountains of Michoacán, during what must have been the best part of the year for botanizing. After the onset of the rains in midsummer, the vegetation in western Mexico reaches its peak in September or October. I have not been able to establish any sequence of events during this period, except that the botanists stayed long enough in Pátzcuaro to study and describe more than twenty species. They were in Jucutacato, near the cataract of Zararacua southwest of Uruapan, on 28 Sep 1790 (AGH 463[2]: 1), and in Uruapan where they received their salary on the 2nd of October (AGH 527[7]: 58). In the *Plantae Novae Hispaniae* some 12 species are cited from Uruapan, and more than 20 in all from Ario and the vicinity of Jorullo. Perhaps the party went first from Pátzcuaro to Uruapan via Tingambato (also cited in the *Plantae Novae Hispaniae*), then after a side trip to Jucutacato, went from Uruapan to Ario and Jorullo, and thence through the hot lowlands to Apatzingán, where they arrived at least by the 20th of October (AGH 461[4]; Sessé to Revilla Gigedo). They drew their salary in Apatzingán on 1 Nov 1790, and evidently made their base there for something more than a month.

The three-month period beginning with the arrival of the Expedition at Apatzingán was the most successful of the entire excursion, from the standpoint of new species studied, described and painted. More than 140 species, about half of them from Apatzingán and vicinity, are cited from southwestern Michoacán in the *Plantae Novae Hispaniae.* This activity was maintained in spite of the fact that the entire party was stricken by fever, as noted by Sessé on 10 Nov (Sessé to Revilla Gigedo, quoted by Wilson, p. 56). Two weeks later (AGH 460: 262) Sessé informed the Viceroy that all were free of fever, and he hoped to go on by short stages to Coahuayana. His departure must have been delayed at least for some days, as on 2 Jan 1791 the party had gone no farther than Tepalcatepec, some 65 km west of Apatzingán. Their route had taken them more or less along that of the modern highway, via San Juan de los Plátanos, Santa Ana Amatlán, and Tomatlán. At Tepalcatepec the party drew their salary for December, and Sessé sent the Viceroy a long report on the accounts of the Botanical Garden for 1788–1790 (AGH 464[1]: 3, 2 Jan 1791, Sessé to Revilla Gigedo; AGH 527[7]: 66).

The three-month period beginning with the arrival of the Expedition at Apatzingán was the most successful of the entire excursion, from the standpoint of new species studied, described and painted. More than 140 species, about half of them from Apatzingán and vicinity, are cited from southwestern Michoacán in the *Plantae Novae Hispaniae.* This activity was maintained in spite of the fact that the entire party was stricken by fever, as noted by Sessé on 10 Nov (Sessé to Revilla Gigedo, quoted by Wilson, p. 56). Two weeks later (AGH 460: 262) Sessé informed the Viceroy that all were free of fever, and he hoped to go on by short stages to Coahuayana. His departure must have been delayed at least for some days, as on 2 Jan 1791 the party had gone no farther than Tepalcatepec, some 65 km west of Apatzingán. Their route had taken them more or less along that of the modern highway, via San Juan de los Plátanos, Santa Ana Amatlán, and Tomatlán. At Tepalcatepec the party drew their salary for December, and Sessé sent the Viceroy a long report on the accounts of the Botanical Garden for 1788–1790 (AGH 464[1]: 3, 2 Jan 1791, Sessé to Revilla Gigedo; AGH 527[7]: 66).

From this point the Expedition crossed the divide into what is now Jalisco, through mountains that even today are almost inaccessible to motor vehicles, to the valley of the Río Ahuijullo, which they followed down toward Coahuayana. Even

when traveling with pack-animals the botanists seem to have been impressed with the terrain, as there are several references in the *Plantae Novae Hispaniae* to the "montibus inhospitalibus" between Tepalcatepec and Coahuayana. I have not been able to fix specific dates for the stay at Coahuayana, but evidently the sojourn was a profitable one, as more than 30 species are cited from this place and the nearby shores of the Pacific Ocean. Probably the next move was early in February, as flowering dates in that month are cited for species from Colima, from Tonila, from the foothills of the Volcán de Colima, and from Zapotlán (today Ciudad Guzmán). Travel was evidently by the regular road from Colima to Guadalajara, which skirts the volcano on the southeast, and after Zapotlán continues northward via Sayula.

But few species are cited from the localities visited by the Expedition after they left Coahuayana; perhaps they were traveling rapidly, but also the country in February and March must have been dry and dusty, and few species new to them could have been observed along this route, which passes for long distances beside and across a series of dry lake beds. The party seems to have been in Zapotlán in mid-February (letter, Sessé to Revilla Gigedo, 13 Feb 1791, "Zospotam," as quoted by Wilson, p. 80), and by the first of April they had reached Guadalajara (Sessé, letter at MA, 1 Apr 1791), where they stayed for about four months. In Guadalajara the Expedition occupied itself in bringing together and organizing the materials gathered thus far, with a view to sending back to Mexico, or even to Spain, whatever could be readied for the purpose. It was there that Mociño must have completed the manuscript of the *Plantae Novae Hispaniae,* as explained elsewhere in this paper. Sessé later wrote that there "se arreglo, y reunio todo lo trabajado que remiti a la Corte por mano de V.E. [i.e. Revilla Gigedo]." Evidently very little new botanical activity was carried on while the party was staying in Guadalajara, as fewer than 10 species are cited from there in the *Plantae Novae Hispaniae.*

Sometime between 22 Jul 1791, when Sessé wrote Revilla Gigedo from Guadalajara and forwarded to him a considerable shipment of manuscripts and paintings (AGH 464[5]: 1–2), and 13 Aug of the same year when Sessé was in Tepic (Sessé to Marqués de Bajamar, quoted by Wilson, p. 50), the Expedition must have travelled to this next stop. The road followed very nearly the course of the modern highway at least as far as Ahuacatlán. Longinos had passed over the same road about four months before, and a lively description of it may be found in his journal (Simpson 1961, pp. 6–10). The road in 1791 turned to the north of the modern road near Ahuacatlán, passing through Tequepexpan and Santa María del Oro, to the north of Cerro Sangangüey, then returning to San Luis and San Leonel before coming into Tepic.

With the departure from Guadalajara, the route of the Expedition ceases to be recorded in the *Plantae Novae Hispaniae.* Fortunately for the historian, the *Flora Mexicana* contains scattered references to collections in the vicinity of Guadalajara from May to July, and from a few localities on the way to Tepic (Amatitán, Tequila, and the Hacienda of Santo Tomás near Hostotipaquillo). Fixed dates and localities are few and far between for the six months that the expeditionaries continued together after leaving Guadalajara. Rickett (p. 29) assumed that the Expedition was divided at Guadalajara into two separate parties, but this does not seem to have been the case. I suspect that they all travelled together as a group to Tepic, thence by the coastal road northwestward through the present states of Nayarit and Sinaloa, as far as southern Sonora. The entire party, consisting of Sessé, Mociño, Castillo, Cerda, and Echeverría, drew their salary at Alamos ["Real de los Alamos"], Sonora, on 21 Oct 1791 (AGH 527[7]: 91), and again at Durango on 2 Jan 1792 (AGH 527[7]: 95). With these two exceptions, our knowledge of their whereabouts during the fall and early winter is chiefly conjectural.

The notion of a division in the Expedition has been derived largely from a long

report that Sessé submitted to the Viceroy a year after the close of the "Third Excursion" (AGH 462[5]: 33; 9 May 1793). Writing of Mociño and Castillo, Sessé wrote that after leaving Guadalajara, "accordamos que [ellos] . . . corriesen por el occidente la falda de la falda de la Sierra Madre hasta los Alamos, y que atravesandola por el Puerto de Canelas [sic], salieron de recorrer la Nueva Vizcaya. . . ." Of his own actions Sessé wrote that he, with another painter and with the anatomist Maldonado, explored Sinaloa and Ostimuri as far as the missions on the Río "Jacqui"; he mentions also his own return from Sonora to Rosario ["llegaba yo de vuelta â el Rosario"]. While in Rosario (AGH 462[3]: 33, quoted by Rickett, p. 29), Sessé received an order from the Viceroy; as this was dated 21 January, Sessé probably received it sometime in February.

The published *Flora Mexicana* contains fewer than a dozen references to localities in Nayarit and Sinaloa (e.g. Acaponeta, Paramita, Sinaloa, and "Mezquite prope Sinaloa"), but among the manuscripts at Madrid (4ª Div., núm. 2) is a stitched notebook of 32 pages that seems to be Sessé's original field book of this period. The descriptions are more or less in chronological order from some localities west of Guadalajara, through Tepic, Ixcuintla ["Yztcuintla"], Paramita, Acaponeta, Rosario, Mazatlán ["Mazatan," or "ad litora Portus Mazatani"], Piaxtla, Vinapa, Culiacán, and Mesquite, to the settlement ["oppidum"] of Sinaloa, and (in October) "maritimis Provinc. Oszimuri." The dates of flowering given for species in the above list are mostly from July to September for the places in Nayarit and southern Sinaloa, October and November from Mazatlán northward. This fits in with the supposition that the party travelled along the well-established coastal road from Tepic to the northwest. Mociño and his companions, even if as Sessé said they were traveling "por el occidente la falda de la falda de la Sierra Madre," could hardly have gone by any other road except the one through the narrow coastal plain, as the extremely rough mountain topography would have made this impossible. I think it probable, therefore, that the party travelled as one until they reached Alamos, after which Mociño and Castillo may well have crossed the Sierra at Canelas, and returned as far as Durango, where they met Sessé and the others (they having presumably ascended by another route) on the 2nd of January. Mociño, according to Rickett, was in Aguascalientes when he learned that the Viceroy had ordered him to join the Nootka expedition; presumably this was in February. We know that Cerda and Echeverría were both in Tepic on 15 Feb 1792 (AGH 462[4]: 1), and it may be that Mociño, en route to San Blas, and Sessé, on his way from Rosario to Mexico, were there at the same time.

The part that Maldonado took in the latter days of the "Third Excursion" is not clear. In Sessé's report of 9 May 1793 he stated that he had been accompanied in Sinaloa the previous year by Maldonado and one of the painters, but Maldonado did not accompany the Expedition when it set out from Mexico in 1790. He had been given a provisional appointment with the Expedition, but his appointment and that of Mociño had been cancelled by Royal Order of 22 Mar 1791 (Rickett, p. 27). Rickett suggested that Revilla Gigedo's solution to this must have been the decision to send Mociño and Maldonado to Nootka. Perhaps Maldonado joined the Expedition in the fall of 1791, but if so he did not receive his salary with the others. Perhaps Sessé paid his expenses, as seems to have been his custom in similar instances, or Sessé may have wrongly reported his name to the Viceroy among those taking part in the work in Sinaloa. At any rate it seems clear that he did join Mociño in San Blas in time to embark on 29 Feb 1792. Wagner & Newcombe (1938, p. 192) state that Maldonado sailed in the brig *Activa,* which apparently left San Blas on 1 Mar (l.c. p. 198).

The botanical results of the "Third Excursion," which effectively terminated in Guadalajara in the summer of 1791, were considerable. Neither the number of specimens collected nor the number of paintings completed was as large as the corresponding number on the "Second Excursion," as the botanists were becoming

more selective and were not finding as many species that were new to them. On the excursion of 1790–1791 they assembled slightly more than 100 paintings, and herbarium collections to the number of 172; the latter are listed with some annotations by Alvarez López (1953, pp. 125–141). The most important result of the excursion was the completion of the manuscript of the *Plantae Novae Hispaniae,* without which we should be lacking much of the information we now have about the early botanical activities of the *Expedición Botánica,* and about the organization and identification of the *Icones Florae Mexicanae.*

After the expedition left Guadalajara in July or August 1791, their only significant accomplishment of which we know anything was the reconnaissance between Tepic and the southern limits of Sonora. It is clear that some or all the botanists expended a deal of time and effort on collecting and describing plants along this route, and presumably some of the material still in the Sessé and Mociño herbarium was obtained during this time. For example, in the herbarium a specimen of *Mozinna cordata* is labelled in the hand of Castillo, and may well have been collected by him in Sinaloa or Sonora.

Longinos Martínez, 1790–1794

Longinos Martínez, the "Naturalist" of the Expedition, ostensibly because of his differences with Sessé did not accompany the rest of the party when they left for the West in May of 1790, but remained in Mexico, as did Senseve, who was left behind in order that Mociño might go (Rickett, pp. 46–49; Simpson, 1961, pp. ix–xi). Longinos remained in Mexico until the beginning of the following year, by which time he had secured the Viceroy's permission to undertake his own excursion to the West, with Senseve as an assistant, and with a military escort provided by the Viceroy. He left Mexico "on or about January 24, 1791" (Simpson, p. xii) and reached the Pacific Coast in about two months. For an interesting and detailed account of his travels for the next three years, the reader is referred to Simpson's edition of Longinos' Journal.

Longinos and Senseve drew their salaries in Querétaro on 29 Jan 1791; in León 13 Feb; in Guadalajara 8 Mar; and in Tepic 10 Apr (AGH 462^5: 20–21; AGH 527^7: 69, 74). They seem to have reached Tepic about the first of April, as Senseve wrote from there on the 2nd (AGH 460: 256). Probably they continued without much interruption to the port of San Blas, as according to Wilson (p. 83) Longinos was there on 20 Apr 1791. A description of the road from Mexico to San Blas forms a part of Longinos' published journal (Simpson, pp. 1–10).

Probably Longinos and Senseve worked for the rest of the year 1791 in the San Blas-Tepic region. There is documentary evidence of Longinos' presence in either San Blas or Tepic on 2 May, 10 Jun, 10 Jul and 12 Aug (AGH 462^5: 20–21; 463^4: 1; 527^7: 89). Longinos (as reported by Wilson, p. 84) informed Antonio Porlier on 7 Jul 1791, that "next week" he intended to "embark for Loreto and Finistire," and presumably on the basis of this Wilson says Longinos and Senseve "embarked for Loreto" sometime in July. As both men drew salary in Tepic on 12 Aug, it is likely that Longinos' plans for sailing to Baja California were changed. Simpson (p. 65) supposed that Longinos spent "six months or more in the latter half of 1791" on the "South Coast," that is, in Nayarit; in another place (p. 111) he states that Longinos was at San Blas from June to December, 1791.

Wilson (p. 85) states that Longinos and Senseve, after reaching Loreto (presumably by sailing vessel from San Blas), "travelled first to Cape San Lucas, where the journal of this portion of the journey begins," and continues, "When they again reached Loreto on their trip northward, Jayme Senseve remained in that port." Simpson implies that the two naturalists began their travels in Baja California at Cape

San Lucas on January 15, 1792, when the journal begins, and states that they reached Loreto overland from the Cape, on the 19th of February, and that Longinos continued northward soon after the first of April. There is general agreement that Senseve did not accompany Longinos further north than Loreto. For Longinos' itinerary and timetable from Cape San Lucas to Monterey, California, see Simpson, pp. 105–111.

Senseve was in Loreto on 2 Apr 1792, when he wrote that he was accompanying Longinos, and expected to go to California with him (AGH 462^5: 1). As explained by Simpson (p. xi) Longinos decided to carry on by himself, because Senseve "even as a student is almost worthless." Senseve was still in Loreto on 2 May (AGH 462^5: 18); he then seems to have crossed the Gulf of California to some point near the mouth of the Yaqui River; he was at "Pueblo de Vican" to draw his salary on 15 Sep; at Villa de Sinaloa on 23 Nov, at Rosario on 31 Dec, and at Tepic (with Longinos who had by this time returned from California by ship) on 5 Feb and 28 Feb 1793 (AGH 527^7: 107, 125, 128, 142). Rickett quotes Mociño as stating that Senseve "had come home alone almost begging his way," but according to the records he received on the average more than 100 pesos a month, or more than he was entitled to on the basis of an annual salary of 1000 pesos! He passed through León on 13 Mar 1793 and ten days later he was in the Capital (AGH 527^7: 139; AGH 462^5: 23–24).

Longinos seems to have left Monterey, California, on the ship *Concepción,* on 3 Sep 1792, and disembarked at San Blas 22 Nov 1792. He did not return at once to Mexico, but instead spent a little more than a year exploring the "South Coast"; that is, in his own words, "from Mescaltitlán, some thirty leagues to the north of San Blas, to the salt pans of Valle de Banderas, sixty leagues to the south of the said Port." His description of the country in his journal (Simpson 1961, pp. 10–17) is short but enthusiastic. He devotes several paragraphs to an account of the useful native palm (by which he apparently means *Orbignya,* although he seems to confuse it with the coconut palm). He says "the forests in all directions are full of it, although it is continually cut away to make room for maize fields." His itineraries on the South Coast, as published by Simpson (pp. 65–66) indicate that he travelled repeatedly through the area from the mouth of the Río Santiago to Punta Mita, and inland as far as Tepic and Compostela. He was in Tepic, as noted above, on at least two occasions in February, 1793; on the 6th of that month he notified the Viceroy that he was sending boxes numbered 4 and 5 of his collections (AGH 460: 162). He was again in Tepic to draw his salary on 3 Apr and 8 Jul of the same year (AGH 527^7: 146, 158). Between these dates, on 12 Jun, he wrote to Revilla Gigedo from the Hacienda "San Josef," "between San Blas and Acaponeta."

Perhaps one or more of his trips toward the south took place after the middle of this year, as he was in Compostela on 7 Sep and again on 6 Nov (AGH 527^7: 160; AGH 460: 176). By the 20th of November he was in Guaristemba (between Tepic and San Blas), and by the 29th of the same month he was in Tepic to get his salary (AGH 463^5: 12; AGH 527^7: 162). At the insistence of the Viceroy he left for Mexico sometime in December; he was in Guadalajara on 27 Dec; he passed through Querétaro sometime in January, and he was back in Mexico by 20 Jan 1794 (cf. Simpson, p. xiii).

In accounts of the travels of Longinos and Senseve in western Mexico from 1791 to 1793, there is no mention of any contact with the other members of the *Expedición Botánica,* who were also in the same region for a part of the same time. Longinos and Senseve passed through Guadalajara on their outward journey in early March, probably while Sessé and his companions were still on the way north from Zapotlán. When the main body of the Expedition passed through Tepic in mid-August 1791, on the way northwest, Longinos was presumably in San Blas; perhaps the two parties met somewhere at this time, but I find no record of it. Longinos and Senseve had crossed to Baja California in January 1792 before Sessé returned to Tepic from

Rosario. Mociño and Echeverría disembarked at San Blas on 2 Feb 1793, at a time when Longinos was active in the area between the port and Tepic. It is hard to imagine how the two could have avoided meeting, but again there seems to be no evidence of such a meeting.

Longinos' contribution to the botanical work of the Expedition is difficult to evaluate, but it was probably not a large one because of the lack of communication between him and the others. He himself often mentioned his interest in plants as well as animals and minerals, but his work seems to have been primarily zoological. He stated in one of his letters to the Viceroy that he had collected more than 30 boxes of specimens of all kinds during the trip to California, but in the Sessé and Mociño herbarium only three or four specimens, these from Baja California or from the Pacific Coast of Mexico, are labelled in his handwriting. To what extent his incidental notes and descriptions of plant life were utilized by the other members of the party I cannot say, but I have found no botanical material attributable to him except the specimens mentioned above.

Mociño and the Nootka Expedition, 1792–1793

Mociño's status on the "Third Excursion" had been an anomalous one; he had never been approved as a full member of the Expedition, and his provisional appointment had been cancelled by the King while the party was in western Mexico. Perhaps to keep Mociño and Maldonado employed and in the service of Science, or at least to delay their discharges for a time by deferring their return to Mexico, Revilla Gigedo ordered them and the "best of the artists" (Echeverría) to join the expedition that was about to leave San Blas for the "northern boundaries of California." According to Rickett (p. 29) Sessé forwarded the Viceroy's order to Mociño who received it in Aguascalientes; this must have been well into February, 1792, as the order was not sent from Mexico until 21 Jan, and Sessé was in Rosario, Sinaloa, when it reached him. Mociño and Echeverría must have hastened by way of Guadalajara and Tepic to San Blas, where according to Wilson (1962, p. 69) "they were joined by Maldonado." On 29 Feb [or 3 Mar; cf. Wilson 1970, p. xliv] they left San Blas with the expedition under the command of Juan de la Bodega y Quadra (Bodega y Quadra, *Viage*: quoted by Wilson, 1962, l.c.) and apparently sailed directly to Nootka, where they arrived on 29 Apr 1792 (Wilson, 1970, p. xlvii). Hardly anything can be added to what Rickett (pp. 29–30) has already said about the sojourn of the biological party in Nootka. Mociño must have been very active in the five months he spent on the island, to judge from his account of the people and their customs and languages in his *Noticias de Nutka* (Carreño, 1913; Wilson, 1970). There is nothing of botanical interest in the *Noticias,* but it was none the less an important document. In the words of Cook (1973, p. 333), "By any standard this was the most valuable first-hand description of Spanish activities at Nootka Sound." It is difficult to say how much botanical work Mociño found time to do. He mentions the work of Echeverría in painting 200 species of plants and some animals, and presumably he worked with the artist in the selection of materials. Two different manuscript lists of plants and animals were included among the reports of the naval commanders of this year. Bodega's report included such a catalogue attributed to Mociño and Maldonado. The latter also took part in a side trip to the north of Nootka during the summer of 1792, and prepared a list of the flora and fauna found near the Port of Bucareli, in southern Alaska (report of Jacinto Caamaño, as edited by Wagner & Newcombe, 1938).

The originals of the above lists are in the files of the Ministerio de Asuntos Exteriores, Madrid. According to Arias, who reproduces them in full (pp. 406–412), they are as follows:

1. (From the report of Bodega y Quadra, A.E. ms. 145). A list of about 250 species presumably from Nootka or from California. Most of the names are those of Linnaean species, but some were evidently thought to be new, e.g. *Azalea nutkensis, Lonicera nutkensis, Sedum nutkense, Prunus nutkensis, Sorbus simplicifolius, Castilleja pulcherrima, Gnaphalium pedunculare.* The same list was reproduced by Wilson (1970, pp. 116–123, with common names and "modern classifications" supplied by Gordon A. Clopine).

2. (From the report of Caamaño, A.E. ms. 10). A list of about 65 species of plants, by Latin names or common names translated from Latin (e.g. "pino silvestre del Canadá," "Escrofularia de Marilandia," "Diente de perro"). This document purports to be that prepared by Maldonado after his trip to Puerto Bucareli and Puerto de San Antonio on the frigate "Nuestra Señora de Aranzazú."

Wilson (1962, p. 73) states that "the majority of the original drawings made by Atanasio Echeverría on the 'expedition of the limits' have disappeared, although a number of copies still exist." Probably like most of the paintings made by the artists of the *Expedición Botánica,* those made at Nootka were only partly finished. Apparently they were still unfinished when Sessé and Echeverría went to Cuba in 1795, and were carried along with a view to their completion, as Sessé wrote to the Viceroy early the next year (Sessé to Branciforte, Havana, 2 Mar 1796; AGH 465[3]: 17) that Echeverría had been sick and had not worked on the paintings from Nootka. Some of the copied plates in the DeCandolle collection at Geneva must have been taken from the originals made at Nootka or conceivably from other localities on the Northwest Coast. Examples are *Cerastium stellarioides* (DC. plate 54, definitely reported from Nutka); *Rubus nutkanus* (DC. plate 291); *Claytonia alsinoides β rosea* (DC. plate 382); *Claytonia parvifolia* (plate 383); *Lonicera mociniana* (plate 446); *Campanula rotundifolia* (plate 704). Doubtless a set of the originals was taken by Mociño to Barcelona when he returned to Spain.

If we may believe Mociño's estimate of 200 species of plants studied at Nootka, a like number of specimens representing these should be found today in the Sessé & Mociño herbarium. Certainly there are numerous specimens that must have come from somewhere in the Pacific Northwest, e.g. *Spiranthes romanzoffiana, Rubus pedatus* [marked on one ticket "Rubus Bucarelensis Sp. N."], *Ranunculus uncinatus, Potentilla villosa, Physocarpus capitatus, Potentilla pacifica, Pyrus rivularis, Rubus parviflorus, Rubus spectabilis, Sanguisorba sitchensis* [labelled "Nutka"], *Spiraea douglasii, Tiarella trifoliata, Tellima grandiflora, Saxifraga stellaris, Erigeron peregrinus, Eriophyllum lanatum, Anaphalis margaritacea, Kalmia polifolia, Moneses uniflora, Lonicera involucrata* [labelled "Nutkensis"], *Artemisia* sp. ["de Nootka"], *Cornus pubescens* ["nutkensis"], *Lysichiton camschatcense, Fritillaria camschatcensis,* and *Symphoricarpos albus* ["Nutka"]. Doubtless there are others that have not been detected.

A smaller, but no less interesting group of specimens seems surely to have come from central coastal California. Many of the Spanish ships of this period stopped at Monterey on the way from Nootka to San Blas. Longinos Martínez, as noted elsewhere, embarked at Monterey on his return to Mexico; possibly some Californian specimens collected between Monterey and San Diego have survived from his collections. It is also possible that Mociño and his companions collected near Monterey on their return to San Blas. Mociño stated that he was five months in Nootka; in fact he arrived just before the first of May, 1792, and departed on 21 Sep (Bodega y Quadra, *Viage*). He reached San Blas on 2 Feb 1793 (AGH 462[3]: 33 bis, as quoted by Rickett, p. 30), so the return voyage from the northwest coast lasted about 4 months. Bodega y Quadra was in Monterey, on the return trip this year, from 9 Oct 1792 to 13 Jan 1793. Assuming that Mociño returned on the same ship (which fits in well with the known dates for leaving Nootka and arriving at San Blas), he must have spent the same 3 months in or near Monterey. There are a few plates in the DeCandolle collection (all

copies as far as known) that surely represent Californian plants. No. 414, the type of *Ribes ? fuchsioides* Berl., evidently represents *R. speciosum* Pursh, a plant known only from central and southern coastal California and adjacent Baja California; the same species is represented in the herbarium by no. 875. A similar case is that of *Sida malvaeflora* DC. [*Sidalcea malvaeflora* (DC.) Benth.], the type of which is DC. plate 70; this is surely a plant of California, not of Mexico as supposed by DeCandolle. A limited number of other specimens in the herbarium (not illustrated by paintings as far as known) pretty certainly came from southern California, e.g. *Eschscholtzia californica* [labelled "californicum"], *Horkelia californica, Eriogonum parvifolium, Ribes malvaceum, Prunus emarginata* [labelled "Prunus californica"]. Some others (e.g. *Collomia heterophylla, Collinsia parviflora, Scrophularia californica*) may have come from California or from further north.

In any event there is sufficient evidence that at least some of the specimens collected in California, at Nootka, and probably as far north as Puerto de Bucareli, found their way into the herbarium of Sessé & Mociño and still form a part of that collection. Likewise some or all the paintings made by Echeverría on the trip to the northwest must have survived and have been copied for DeCandolle. Any specimen or plate of which the identity is doubtful, or which is not Central American, Mexican, or West Indian, should be compared with the floras of California and the coastal regions further north. I cannot explain why none of the material from the Nootka expedition was cited in the *Flora Mexicana,* as copies of Mociño's own report must have been available to him at all times, and we know that the paintings were in the hands of the Director of the Expedition, or at least accessible to him, for several years. Perhaps the northern flora was excluded because it was not "Mexican."

Sessé's Explorations, 1792–1793

As Mociño and his companions went off by sea from San Blas, Sessé, with Castillo and Cerda, returned to Mexico. A long series of letters in the *Archivo Nacional* attests Sessé's presence in Mexico from 2 May 1792 (AGH 462[4]: 2) until at least 20 Jul 1792 (AGH 462[1]: 84–95). He was occupied not only with the results of his recent long excursion, but also with matters that needed his attention at home, including the establishment of the Botanical Garden on a new and better site (Rickett, pp. 18–20). Soon after July 20, however, accompanied by Castillo and Cerda, he set out on a series of field explorations that continued the rest of the year. The earliest of these explorations took the party to the State of Mexico, where more than 70 species, all later published in the *Flora Mexicana,* were described in about a month. Most of the information about the trip has to be gleaned from the brief references in the *Flora Mexicana,* but the date of the excursion can be stated positively, as the two botanists and the artist drew their salary at Temascaltepec on 4 Aug 1792, so probably had left Mexico at least a week before that (AGH 527[7]: 100). They described about a dozen species from Toluca and the surrounding valley, the flowering dates all given as "July" or "August"; 5 species from the Volcano of Toluca ["July"]; about 30 species from Temascaltepec and the nearby mountains (mostly "July"). Leaving the area of Temascaltepec, the group seems to have visited in turn El Valle [Valle de Bravo], the mountains between El Valle and Malacatepec [1 species, "Augusto fructificantem observaverimus"]; Malacatepec; Zitácuaro, and the mountains between that place and Malacatepec (9 species, "August"). The details of their return to Mexico are unknown to me. On 2 Sep 1792 they received and signed for their salary at Ixmiquilpan, some 34 leagues almost due north of Mexico, and I suppose before this they returned to Mexico by the regular road from Morelia, perhaps joining this at Maravatío or Tepetongo, thence proceeding southeastward to San Felipe del Obraje (whence they

cited 3 species flowering in "August"), San Antonio, Ixtlahuaca, and Toluca. Humboldt passed over the same road a decade later.

Of the field excursions that followed this one, almost nothing is definitely known. The records show that Sessé, Castillo, and Cerda drew their salary in Ixmiquilpan as noted above, in Jalapa on 2 Nov 1792, and in Puebla on 18 Dec (AGH 527[7]: 105, 115, 122), and presumably they were in the field in Hidalgo, Puebla and Veracruz most of this autumn season. From the *Flora Mexicana* it is possible to glean evidence of two or three principal excursions in these states during the months in question, but of course travels of any one year cannot be identified as such in the flora.

The citations in the *Flora* suggest that the first part of the autumn's work was in Hidalgo; that on the way to Ixmiquilpan the botanists passed through Alfajayucan, whence they described 6 species [4 said to flower in August, 1 in July or August, 1 in September]; that they continued to Cardonal, San Juan Amajaque, Metztitlán [5 species, "August"], Santa Mónica [2 species, August and September], and Atotonilco el Grande [1 species, "September"]. The visit to the last locality can be dated with some assurance, as the species described from there, *Polymnia depressa,* is represented in the Sessé and Mociño herbarium by a specimen [of *Dugesia mexicana* A. Gray] labelled in the hand of Castillo. As Castillo died in July 1793, the plant must have been collected in September 1792.

When the Expedition reached Atotonilco they were only a few leagues from Pachuca on one of the principal highways out of Mexico, and they may have returned to the Capital in September. I think it likely, however, that they went on east to the next considerable town, Tulancingo, and began there an excursion into the hot country of Veracruz, as indicated by the citations in the *Flora Mexicana.* The itinerary is tentatively reconstructed as follows:

Locality	Number of species cited in Fl. Mex.	Dates of flowering
Tulancingo, [Hgo.]	2	August
Zacatlán, [Puebla]	3	September
Hueytlalpan, [Pue.]	3	August–October
Huehuetla, [Pue.]	7	September–October
Zozocolco, [Ver.]	8	August–October
Tenampulco, [Pue.]	10	August–October
Coxquihuí, [Ver.]	1	–
El Espinal, [Ver.]	7	August–October
Papantla, [Ver.]	2	October

As Tenampulco, Coxquihuí and El Espinal are very close together it seems likely that a base of operations was established for a time in the vicinity. It may be surmised further that at the conclusion of the excursion to Papantla, the expedition moved southward through the lowlands as far as Jalapa, thence to Puebla, probably by the regular road to Mexico. Nothing from Jalapa is cited in the *Flora Mexicana,* and almost nothing from Puebla.

Sessé was back in Mexico by 13 Jan 1793 (AGH 460: 172) and seems to have remained there most of the time until at least 8 Jun of the same year, as attested by various documents in the *Archivo Nacional* (AGH 460: 164, 171, 172, 180, 189; 462[1]: 46; 527[13]: 39–41, 42, 46–48). On the 9th of May Sessé noted that Castillo had been sick since 18 Apr, with symptoms of scurvy. On the 28th of March he noted that Mociño and Echeverría had not yet reached Mexico (Sessé to Acuña y Malvar, quoted by Wilson, p. 196), but apparently they were not delayed long after this, as on 9 Apr Sessé notified Revilla Gigedo that the Expedition was ready to set out in two parties, as described by Rickett (p. 30). Sessé and one artist were to set out to the

northeast, and Mociño with the other artist to the southeast. Mociño and Echeverría were in Mexico at least by 13 Apr (AGH 460: 191), about 10 weeks after they landed at San Blas from the Nootka expedition.

Sessé was ill for some months in the latter part of 1793, and probably did not carry on any very strenuous botanical work either in this year or the following one. His expedition to "la Guasteca y Provincia de Santander" seemingly never materialized. With one artist (Echeverría), he moved to Puebla on 15 Jun 1793; the two drew their salary there on the 18th, then moved to Orizaba where they were paid again on 4 Jul. On the 13th of July Sessé wrote to Revilla Gigedo from Córdoba, notifying him of the shipment of some bulbs, and also some geological specimens from near Perote (AGH 527^{13}: 52–53; AGH 527^{7}: 148, 153; AGH 527^{4}: 5; AGH 460: 195). At MA there is a list of 183 species of plants, "Herbario remitido desde la Villa de Cordova en Agosto de 1793" (4^{a} Div., núm. 15). In the *Flora Mexicana* about 20 species are cited from the vicinity of Orizaba (1 from near the Volcano of Orizaba), and about 60 species from the vicinity of Córdoba; most of the species are said to flower in July or August. I suppose most of these were collected and described during Sessé's sojourn in Veracruz in 1793. He seems to have maintained his headquarters at or near Córdoba at least from mid-July to mid-October. At least one of his letters (AGH 464^{19}: 1–2; Sessé to Viceroy, 7 Sep 1793) was written from the Hacienda de Toxpa, a locality cited several times in the *Flora Mexicana* as "near Córdoba" or "near Orizaba." Initially he had planned to explore some of the mountain ranges of southern Veracruz, but his illness and that of Cerda had prevented this. Echeverría, who had been with Sessé in June and July, was by this time on the coast with Mociño. On 12 Oct Sessé wrote that he was recovering, but still unable to visit the "Sierra de Songolica" as he had planned (AGH 464^{19}: 3). Soon after this he removed to Puebla to recuperate; on 10 Nov he had been there at least a week, and planned to return to Mexico as soon as he was strong enough (AGH 464^{17}: 14; 464^{19}: 7; 462^{6}: 7; 462^{7}: 1). He was in Mexico at least soon after the first of February (AGH 462^{7}: 5–7; Sessé to Revilla Gigedo, 6 Feb 1794), and seems to have been more or less continuously in the city from then until his departure for Cuba a little more than a year later. The first part of the year is documented by a number of letters and other manuscripts; Sessé was occupied for much of his time by the controversy with Longinos (see Rickett, pp. 49–51, where this is described). I have not been able to find any direct evidence of Sessé's whereabouts between 2 Jul 1794 (AGH 527^{12}: 61–90; letter, Mexico, Sessé to Revilla Gigedo) and 8 Feb 1795 (AGH 464^{17}: 35; Mexico, a list of Castillo's books in Sessé's hand), and it is possible that he undertook some field excursion during the fall of 1794.

Mociño in the Southeast, 1793–1794

Mociño, having returned from the Pacific Northwest about the first of April, 1793, seems to have been ready to set out again immediately. With Echeverría he reported to the Viceroy on 13 Apr (AGH 460: 191); then within a week, this time in company with Cerda, according to a note in the *Archivo General* (AGH 462^{5}: 33 bis) Mociño went out to examine the "Sierra de Papalotípac, y la Misteca, hasta la raya de Goatemala." This is so vague as to make one suppose it was intended for no more than an administrative generality. There is a place called Papaloctipa in northern Puebla, northeast of Tulancingo, but this is northeast of México, and the references to the "Misteca" and to "Goatemala" suggest a trip to the southeast. Actually he must have turned soon to the southeast, as on 23 and 24 May, when the clouds of ashes from the erupting volcano of Tuxtla reached Oaxaca, he was in that city (Carreño, Not. Nutka 108).

On 27 Jul 1793 (AGH 527[13]: 55–56), Mociño wrote from Córdoba to Revilla Gigedo, acknowledging the receipt of the "oficio" informing him of his separation from the Expedition (as noted above, this was in accordance with the Royal Order of 22 Mar 1791, whose execution had been long delayed). Mociño stated that as he had just been traveling in the Mixteca, he had not received the order until July 19. It may be supposed that the order caught up with him in Oaxaca, and that he had then come to Córdoba to confer with Sessé, who had been there some weeks. Before the end of the month the news of Castillo's death on July 26 had reached Córdoba, and Mociño wrote at once to Revilla Gigedo, asking for the vacant position (AGH 464[17]: 3; Córdoba, 31 Jul 1793). The Viceroy acceded to this request, and Mociño finally became a full member of the Expedition, appointed provisionally on 24 Oct 1793, and this confirmed by Royal Order on 16 Sep 1794.

Without waiting for his appointment, Mociño set off for the coast of Veracruz with Echeverría; Cerda presumably remained behind with Sessé at this time. The decision to leave Córdoba at once may have been made in response to an official request, as in Sessé's letter of 7 Sep from Toxpa, he notes that Mociño has been asked to observe the active Volcán de Tuxtla, and says that probably a circumstantial account of the eruption would already have been available except that both Mociño and the artist had been stricken with illness on the way south ["si este activo profesor, y el dibujante D. Athanacio Echavarria, que la acompañaba, no huvieran enfermado en la boca del Rio [Alvarado?], distante mas de Veinte leguas de aquel Volcán"]. Sessé says further that Mociño and Echeverría are coming back to Veracruz to convalesce. Evidently the convalescence was not long delayed, as Mociño by 22 Sep had returned to San Andrés Tuxtla and on the 23rd made his first ascent of the volcano (AGH 464[16]: 6; 464[19]: 3). Probably Mociño made his headquarters in San Andrés for some weeks (see Rickett, pp. 31–33). He made his second ascent of the volcano on 21 Oct. While at San Andrés he wrote out his notes on the Volcano, and also his *Noticias de Nutka*. He seems to have been in San Andrés on 13 Oct, and 16, 22 and 27 Nov (AGH 527[13]: 58; AGH 464[17]: 12; Rickett, p. 32; Carreño, Not. Nutka 117). Either during this period, or at some time the following year, Mociño must have collected at nearby localities in southern Veracruz, e.g. the following, from which several species are cited in the *Flora Mexicana*:

Locality	Number of species cited in *Flora Mexicana*	Month of flowering
Río de Alvarado	4	June–September
Tlacotalpan	6	June (5)–August
Tuxtla	59	June–July (32) August–December (27)
San Andrés de Tuxtla	1	November
Acayucan	14	August–September (5) December (6)

Rickett (p. 31) says Mociño went by ship from Veracruz to San Andrés; perhaps he travelled more than once by this means. On 22 Feb 1794 he wrote the Viceroy, from Veracruz, sending a box of specimens collected the preceding year "en la Costa de Sotavento por donde hicimos nuestras peregrinaciones." The same collection was mentioned on 3 Apr 1794, with notice of a fossil from near Acayucan (AGH 460: 206, 207). There are other references in the correspondence to Mociño's work on the "Costa de Sotavento," the "lee shore," but I take it this generally referred to work in the lowlands near the coast, not in a coasting vessel. On April 25 (AGH 460: 216) Sessé noted that Mociño now had ten boxes of plants in Veracruz, "las plantas mas apreciables de aquella Costa. . . ." Probably his work in Veracruz had continued through the winter.

Sessé supposed on 23 Mar 1794 (AGH 463[7]: 1–2) that Mociño was going to Tabasco. On 12 Apr (Rickett, p. 33) he noted that "not a post fails to bring a complaint from Mociño [in Veracruz] that the best season for collecting is slipping away" (passports for Mociño and Echeverría had been requested, but had been delayed). Just what Mociño decided to do in the summer of 1794, I do not know. Probably he did not attempt to go further south until somewhat later. Early in August he was back in San Andrés, sending zoological specimens to the Viceroy (AGH 460: 156. San Andrés, Mociño to Branciforte, 3 Aug 1794). Some weeks later the Viceroy was advised from Veracruz that Mociño "se halla en la Costa de Sotavento" (24 Sep 1794; J. de D. Ximenez to Branciforte; AGH 460: 213). Then begins a period of more than six months when Mociño disappears from sight; I do not find any documents relating to his whereabouts during this time, but I suspect that his trip to Tabasco took place in the fall of 1794. Arias (p. 182) quotes a letter written in 1794 by Sessé, to the Viceroy, saying ". . . Provincia de Tabasco, que en el día está recorriendo don José Moziño." Other evidence of this is found in the pages of the *Flora Mexicana,* where the following localities are cited:

Locality	Number of species cited in the *Flora Mexicana*	Month of flowering
Coatzacoalcos (and the river of the same name)	2	November
Cozoliacaque	1	November
Ocoapam	2	October
Ahualulco	51	June? to November (3 Aug, 7 Sep, 21 Oct, 8 Nov)

Two of the species described from Ahualulco are given the epithet "tabascense" (*Solanum tabascense, Cynanchum tabascense*), indicating that the locality was in Tabasco, or Mociño thought it was. Unfortunately I have not been able to locate any place of this name in Mexico except the one in Jalisco; the latter was supposed by Sprague (1926, p. 423) to have been the Ahualulco of the *Flora Mexicana,* but the plants described in that work evidently pertain to a flora of the wet tropical lowlands (e.g. including many epiphytic orchids, Melastomataceae, and Piperaceae), not of the semiarid hill country of Jalisco. Orozco y Berra (Orozco y Berra, M. Apuntes para la Historia de la Geografía en México. p. 88. Mexico, 1881) states that the name Río de Agualulco (or Aguayaluco) was applied in the 16th Century to what appears on modern maps as the Barra de Santa Ana, some 75 kilometers east of the boundary between Veracruz and Tabasco. The Ahualulco of the *Flora Mexicana* may well have been in this general area; certainly it must have been in western Tabasco or adjacent Veracruz. One species described in the *Flora Mexicana,* with type-locality Ahualulco, is *Solanum ocoapense,* i.e. presumably from near Ocoapán. I can find no place of this name in the region except in western Tabasco, near Mecatepec and Huimanguillo. The conclusion that Mociño worked for some time in this part of Tabasco is admittedly inferential, but the bits of evidence seem to be consistent. My tentative assumption is that he left Tuxtla in August or September, 1794, travelled by way of Acayucan and Cozoliacaque to Ahualulco and Ocoapán, worked especially near Ahualulco until early in November, when he returned probably by the same route (cf. collections made in Acayucan in December).

At the beginning of the year 1795 all the members of the *Expedición Botánica* were in Mexico for the first time in many months. Longinos seems to have remained in that city after his return in January, 1794; for more than a year he continued his controversy with Sessé. He seems to have been still in Mexico on 29 Jun 1795, when he was ordered to leave for Guatemala, whither the "botanico y pintor" (Mociño and Cerda) had preceded him. From February to April, 1795, Sessé was busy in Mexico

with plans for exploration of the West Indies and Central America. Mociño probably was in the city from mid-April (AGH 464[24]: 30–32. Mexico, Mociño to Branciforte) until his departure for Guatemala two months later.

Sessé and the West Indies, 1795–1798

The travels and tribulations of Sessé and Echeverría in the West Indies have been summarized by Rickett (pp. 41–45), and by Wilson (pp. 228–244). While Mociño was still in Mexico trying to obtain a passport, Sessé left the Capital with Senseve and Echeverría on 22 Apr 1795; they were in Puebla on the 24th, left Veracruz on 5 May, and arrived at Havana on 30 May 1795 (AGH 461[7]: 4; 464[24]: 75–76; Wilson, p. 228; AGH 465[3]: 4).

For the next nine months Sessé carried on desultory botanical activity near Havana. The *Flora Mexicana* contains nearly 100 citations of Cuban species, essentially all from the vicinity of the city. A little more than a week after his arrival (AGH 462[7]: 15; 465[3]: 4. 8 Jun 1795) Sessé informed Branciforte that they could not reach the interior of the island because of the rains which hindered all botanical work. At the end of August (AGH 465[3]: 16; 465[6]: 10. 30 Aug 1795. Sessé to J. P. Valiente) water was still interfering with botanical work, and the artist, Echeverría, had been unable to work because of illness. Even by the first of the following March Echeverría had been unable to complete his paintings from Nootka, which he had brought to Cuba for that purpose (AGH 465[3]: 17). There are two references in the *Flora Mexicana* to species of ferns collected "in flumine de Guantanamo," but with that exception all of Sessé's Cuban localities are described by him as "near Havana" or "in Havanae suburbis"; perhaps even the ferns were brought to his notice by someone else who had been in eastern Cuba. Sessé was in Havana also after his return from Puerto Rico, from June 1797 until March 1798.

The trip to Puerto Rico seems to have been somewhat more productive than the two sojourns in Cuba. We know little of the trip itself except what Rickett and Wilson have already told. Sessé informed the Viceroy of their intentions on the eve of the departure from Havana (AGH 465[3]: 17. Havana, Sessé to Branciforte, 2 Mar 1796). We know from Sessé's letters that he and Echeverría began work in Puerto Rico early in April, 1796, and finished at the end of August (or the end of September!). By March 1797 (Wilson, p. 231) they had "described and drawn . . . nearly three hundred plants." They left Puerto Rico on 12 May 1797, and reached Havana 1 Jun 1797 (AGH 461[7]: 58–59; 461[7]: 3; Wilson, pp. 231, 233; Rickett, p. 42).

The *Flora Mexicana* contains approximately 180 references to plants from Puerto Rico, and from these it is possible to draw a number of inferences as to the activities of Sessé and his companions. Urban (Symb. Antill. 4: 1–771. 1903–1911) listed most of the Puerto Rican species. He relegated almost all the new species to the synonymy of older ones, stating (p. 666), "Es gelang mir auch, dieselben mit Ausnahme von einigen wenigen, besonders Myrtacen, mit Sicherheit aufzuklären." Urban also gave a short sketch (l.c. 665–666, 1911) of the activities of the Botanical Expedition, and listed (with some corrections in spelling) the Puerto Rican localities cited in the *Flora Mexicana.* There are about 25 such localities, in addition to small intermediate stations [e.g. "in Praedio de Josefo Garcia juxta iter de *Toa Alta* ad Saibanito interjectum"].

In contrast to the Cuban localities cited in the *Flora Mexicana,* those from Puerto Rico are representative of almost all parts of the island. I have no documentary evidence relating to the itineraries followed by Sessé and his party while they were in Puerto Rico, but from the places and dates of flowering cited in the *Flora,* and from the known dates of their stay on the island, the following is tentatively set forth:

Locality	Dates of flowering	Number of species
Puerto Rico	February–May	12
Toa Alta	March–May	18
Río Laxa irrigating Toa Alta	April	1
García Hda., road from Toa Alta to Saibonito	May	1
Aibonito (Saibonito)	May–June	3
Coamo	April–June	8
Ponce	June	8
Yauco	May–June	2
San Germán	–	1
Cabo Rojo	May–August	3
Shore between the port of Cabo Rojo and Aguadilla	June	3
Between Rincón and the port of Aguadilla	June	2
Aguadilla (port and city)	May–June	5
Between Tuna and Camuy	–	1
Arecibo	June	2
Between Arecibo and Manatí	June	1
Between Manatí and Naranjal	June	1

The above suggests that after beginning to collect in the mountains of Toa Alta, and in the vicinity of the port (now San Juan), the party crossed the island to Ponce and followed the road to the west end, returning probably in June by way of Arecibo and Manatí.

A similar case may be made for a trip to the east end of the island in the latter part of the year 1796:

Locality	Dates of flowering	Number of species
Puerto Rico	June–November	30
Cangrejos to (?) Ingenio Viejo	August–September	2
Río Piedras	September	1
Loiza	August–September	3
Luquillo	August–September	6
Fajardo	June–August	3
Humacao	July–August	6
Caguas	–	1

As the party remained in Puerto Rico until May 1797, the species described from Toa Alta and the surrounding mountains, and from the vicinity of the city of Puerto Rico, may have been studied either in 1796 or 1797, but from Sessé's statements that the botanical exploration had been completed the first year, it seems likely that the early spring of 1797 was devoted to other things. The excursions as reconstructed above are based on inferences and may be inaccurate in detail, but at least it seems clear that Sessé and his companions travelled extensively overland, and visited one series of localities during the spring and early summer of 1796, and a second series of places from July to September.

In the Sessé and Mociño herbarium about 20 species are more or less definitely stated to have come from Puerto Rico, and about 35 from Cuba (nothing is identified as from "Cuba"; one specimen is labelled "ex Guanavacoa," and the rest as from Havana).

Sessé's statement, quoted above, that by March 1797 the Expedition had described and drawn nearly 300 plants, may have referred to the work in Puerto Rico alone, or to the combined work in Cuba and Puerto Rico. If the former, then about two-thirds of all the Puerto Rican species were published in the *Flora Mexicana*; if the latter, then nearly all the West Indian species must have been published in that work.

Rickett (pp. 42–45) has published a lively account of the return from Puerto Rico to Havana, via an American vessel willing to run the English blockade. The party was ready to sail on 20 Apr, but because of the blockade their departure was delayed until 12 May 1797. Rickett (quoting AGH 461[7]: 17–22, 50–54) gives the date of arrival in Havana as 1 Jun; Wilson (p. 234) gives it as 10 Jun. As soon as they reached Cuba, Sessé announced his intention of exploring the western part of the island, in spite of the fact that the Expedition (which had been extended for two years by Royal Order of 15 Sep 1794), had officially terminated, and Sessé and his companions had been ordered to return to Spain at once. Another Spanish survey expedition, that of the Conde de Mopox y Jaruco, had reached Havana just before Sessé's return, and he seems to have spent the rest of the year 1797 in a kind of delaying action. He conferred with the members of the other expedition, which included a botanist, Baltasar Boldó, as to means of cooperation in continuing the exploration of Cuba. He recommended to the Conde de Mopox y Jaruco the employment of a young Cuban, José Estévez, who had been a diligent and successful pupil on the trip to Puerto Rico. He consented that Echeverría separate himself from the Botanical Expedition and attach himself, with an increase in salary, to that of the Conde de Mopox y Jaruco (Wilson, p. 237). He requested some extension of time to permit him to return to Mexico and oversee the completion of the paintings, and he offered a plan which amounted to the establishment of a botanical garden in Havana, to be in charge of Mariano Espinosa, who was a correspondent of Gómez Ortega. He blamed the British blockade for some of the slowness of communication. The best account of this period may be found in Wilson's book (pp. 234–244).

Probably nothing ever came of Sessé's plans to explore western Cuba, as no localities from that part of the island are cited in the *Flora Mexicana.* Senseve (cf. Rickett, p. 44) left for Mexico on 11 Sep 1797, and reached that city a little less than a month later. Echeverría having resigned (or defected), as Sessé implied in November (AGH 465[10]: 3–6; Havana, 18 Nov 1797, Sessé to Branciforte), the West Indian division of the Expedition was reduced to little more than a Director. Sessé finally sailed from Havana 18 Mar 1798, arriving in Mexico on 12 May (Rickett, p. 44, quoting AGH 461[7]: 54).

As far as the record shows, Sessé's botanical exploration ended with his expedition to the West Indies. The Archives in Mexico show that he was in that Capital on various occasions for the two years following his return from Havana. There is hardly any record concerning the year 1800; I find nothing except a letter dated 2 Apr (AGH 464[24]: 100). The first half of 1801 is well documented; Sessé was in Mexico without any long interruptions (AGH 461[7]: 83–86, 90; 462[7]: 24, 29, 46, 48; 465[14]: 2). In August of this year (cf. Rickett, p. 71) Sessé was subjected to a legal restraint that prevented his return to Spain for another year and a half. The record seems to be silent concerning his activities from July 1801 until March 1802, and again from April 1802 until January 1803, when begins an extensive series of communciations with the Viceroy, Yturrigaray (AGH 464[3]: 21; AGH 465[13]: 18–19; 465[15]: 14, 15–18, 24; 465[16]: 9–10, 17–19; 465[17]: 2, 5, 8). Evidently the legal charges against Sessé were settled by March of 1803, and about the middle of that month, having been ready for departure for a year or more, he left for Veracruz with his family and servants.

Mociño in Central America, 1795–1799

As noted by Rickett (pp. 35–38), there is a detailed record of the itinerary of these years in the *Archivo General,* but we know very little of the trip itself except through the 20 or so salary receipts that were signed by Mociño and Cerda between

September 1795 and December 1798. These records are in AGH 465[6]: 8–31, and 465[14]: 6–11.

The original plan had been to have Longinos Martínez accompany Mociño and Cerda to Guatemala (cf. Rickett, pp. 34–35, 53), but neither Longinos nor Mociño could tolerate the other; Mociño managed to secure a passport for himself and for Cerda, and left Mexico on 22 Jun 1795 (AGH 465[12]: 1, quoted by Rickett, p. 35), just two months after Sessé's departure for Havana. Julián de Villar, who had accompanied Mociño on his ascent of the Volcán de Tuxtla in 1793, seems to have travelled with Mociño and Cerda, although not officially a member of the party. Villar was at least in Guatemala with the others on 14 Sep and 3 Oct 1796 (AGH 465[7]: 10; Wilson, p. 225), and probably travelled with them from Mexico, although as Rickett says "it is not clear whether or not he accompanied them on part of their journey." Longinos in the meantime lingered in Mexico for at least a week after the other left.

Mociño and Cerda spent the first year of the journey in getting to Guatemala. Apparently they worked for four months in the region of Puebla and Tehuacán; the last communication from Tehuacán (AGH 465[6]: 15; Mociño to Branciforte) was on 4 Oct 1795, when Mociño informed the Viceroy he was sending on a half-dozen "dibujos" for Cervantes.

After a period of some weeks in the vicinity of Oaxaca (where they drew their salary on 6 Nov and 16 Dec 1795), they must have begun their journey toward the Isthmus of Tehuantepec in late December or early January, as they were in Zoquitlán on 20 Jan 1796, and in Tehuantepec by the 9th of February. I suppose they travelled by the regular road to Tehuantepec; that is, southeastward toward Nejapa in the headwaters of the Río Tehuantepec. Rickett (p. 37) says "They left the great valley of Oaxaca, crossed the high mountains to the east (passing through country still wild, still insufficiently known to botanists), and descended into the valley of the Río Tehuantepec." I do not know the basis for this statement, but I suppose it is not to be accepted at face value. It is more likely that the route of Mociño and Cerda passed considerably to the south of the high mountains east of Oaxaca (i.e. those culminating in the peak of Zempoaltepec). The route out of the Valley of Oaxaca to the southeast passes through semi-arid plains and foothills before dropping off abruptly to the Río Tehuantepec, but never ascends to any great height.

The Expedition paused at Tehuantepec for some three months; as Rickett says it must have been a mellow season of dry weather and mild sunshine. Their last installment of salary at this place was received on 14 May 1796; three weeks later they were in Chiapas. I cannot explain why the *Flora Mexicana* and the manuscript flora of Guatemala contain so few references to plants from the Puebla-Tehuacán area, from the valley of Oaxaca, and from the Isthmus of Tehuantepec, in all of which areas the expedition spent weeks or months. In the entire Sessé and Mociño herbarium there are only two or three specimens labelled as from Tehuantepec, about the same number from Tehuacán, and even fewer from Oaxaca. In the *Flora Mexicana* only about a half-dozen species are cited as from Tehuacán, and one "inter Tehuacam et Oaxacam prope iter"; none is cited from the isthmus of Tehuantepec. In the manuscript of the Guatemalan flora there are hardly any more references to these places (about 4 to the mountains near Tehuantepec; to Juchitán, Tehuacán, and Tehuantepec 1 each).

While Mociño and his companions were in Tehuantepec, Longinos Martínez seems to have passed through on his way to Guatemala. Longinos had left Mexico about the end of June, 1795 (cf. Rickett, p. 53). From a letter written by him in Guatemala nearly a year later we can surmise what his route thither may have been. Probably he went from Mexico to Puebla, thence to Veracruz. He tells us that he ascended the Río Coatzacoalcos for 15 days in a boat, until he "arrived at the border of this kingdom [Guatemala]" (Wilson, p. 217, quoting a manuscript, Legajo no. 704, in the *Archivo General de Indias,* Sevilla). It seems probable that this is a literary foreshortening of his

journey. Presumably he crossed the Isthmus of Tehuantepec from somewhere on the upper navigable reaches of the river; he met Mociño and his party, perhaps at Tehuantepec in March or April of 1796. Longinos himself probably continued his travels through the Pacific lowlands, as he tells us that he "ordered" Mociño to take the high road and thereby increase the territory covered by "our excursions" (AGH 465^{6}: 28. ". . . ordene al Botanico D^{n}. Josef Moziño biniese por el camino de los altos para abrasar mas terreno en nuestras excursiones"). Mociño, as described below, seems to have taken kindly to the suggestion that he follow the mountain route.

Longinos was in Guatemala at least by 3 Jun 1796, having passed by the "Province of Soconusco" (presumably in coastal Chiapas), "through this until that of San Antonio Suchitepeques and that of Escuintla, examining all the coast, which was a continuation of the Costa del Sur, . . . and then . . . to this capital to arrange his works" (Wilson, p. 217). Longinos' letter of 3 Jun (AGH 465^{6}: 28) implies that this journey along the coast continued "hasta cerca de Sonsonate" (that is, in present El Salvador) before it ended in the City of Guatemala.

Here in Guatemala Longinos passes from our story. He remained in the Capital for some years; apparently he gave lessons in Botany, and established a Museum of Natural History. The story of his death is told briefly by Rickett (p. 53, quoting from AGH 465^{14}: 1 and AGH 465^{17a}: 1, 2). He had been ill for some time, apparently with tuberculosis. In 1801 he determined to return to Mexico. He reached Campeche late in 1802, and there died. His collections, if any survived him, never reached Mexico.

Mociño in the meantime came to Ciudad Real[1] about the same time that Longinos reached Guatemala. As noted by Rickett, he returned a box of specimens to the Viceroy, Branciforte, on 6 Jun 1796 (AGH 465^{6}: 25). At this time or on the return trip in 1798, the botanists collected and described a relatively large number of species in this region. The manuscript Flora of Guatemala refers to more than 50 species from Ciudad Real, almost 20 from Chiapa (that is, presumably Chiapa de Corzo), and about 20 from Teopisca. Of all these only one came to publication in the *Flora Mexicana* (*Cytisus nigricans*, "in Comitani ac Civitatis Regiae circuitibus"). It may be supposed that Mociño and the others, on their first visit to Ciudad Real, made the city their headquarters for some time before they continued through the mountains to Central America. They were in the City of Guatemala at least by the 14th of September (AGH 465^{7}: 10. J. Domás y Valles to Branciforte, 15 Sep 1796), and apparently spent the rest of the year in or near that city. A note from "Goatemala" on 3 Dec 1796 (AGH 465^{6}: 31. Presidente to Branciforte) states that Mociño and Cerda "proximamente saldran de esta ciudad."

The manuscript flora of Guatemala lists about 125 species from the general locality of "Guatemala," by which the authors seem to have meant usually the capital city itself, not the region or country of the same name; some 42 species are listed as from "Guatemalensibus hortis." About 30 species are listed from "Cuchumatanum montibus," and about 20 from the vicinity of Totonicapán, both localities along the route between Ciudad Real and Guatemala, so that either coming or going the party must have botanized for some time in the mountains of northern Guatemala.

The route from the isthmus of Tehuantepec, as indicated by citations in the Flora of Guatemala, led the party by way of Ocozocoautla, Tuxtla, Chiapa [de Corzo], Ciudad Real, Teopisca, San Bartolomé, Xocoltenango, Comitán, Zapaluta, and Escuintenango. The last was described by Gage (1958) in the first quarter of the 17th Century as on a well-travelled road to the southeast, where "no man nor beast travelling

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[1] Also known as Chiapa Real, or Chiapa de los Españoles, the latter to differentiate it from Chiapa de los Indios. The latter is now known as Chiapa de Corzo; Chiapa Real is the modern San Cristóbal de las Casas. Rickett equated Ciudad Real with Chiapa de Corzo.

to Guatemala can go into it, or from Guatemala can go out of it, but by ferrying over."

Judging from the citations in the Flora of Guatemala, Mociño and his companions continued on upriver (the stream is a tributary of the Grijalva) into the territory of Guatemala, passing San Martín (Cuchumatanes), Santa Ana Huista, and probably crossing somewhat southwest of the highest part of the Cuchumatanes to Huehuetenango. More than 30 species are cited from these mountains, including several from the "frigidissimo Moscosi Praedio," an hacienda I have not been able to locate. From Quezaltenango, Totonicapán, and Argueta they continued to Chimaltenango, to Antigua Guatemala, and to the newer capital where this stage of the journey terminated.

Mociño and Cerda drew their salary in San Salvador on 4 Mar 1797, so if they arranged for this as soon as possible after their arrival, they must have been on the road from Guatemala in January and February. From "Nueba Goatemala" they turned toward the coast, passing through Azacualpa ["Zacualpa"] and Jalpatagua and into El Salvador before reaching Ahuachapan. Santa Ana Grande, and Nejapa, both cited in the Flora of Guatemala, may have been visited at this time en route to San Salvador. Sonsacate and Sonsonate, off to the southwest near the coast, may have been visited later on an excursion from San Salvador. Continuing on the road to San Miguel, the party seems to have passed through Cojutepec, Apastepec, Tepetitán, and Zacatecoluca, crossing the Río Lempa somewhere east of this last place, or perhaps further north on the way to Chinameca. The greatest amount of botanical activity, as suggested by the citations in the flora, was near San Salvador itself (about 35 species described); at San Miguel (17 species); and in the region of Sonsonate (9 species). One species from Sonsonate, said to flower in March, was published in the *Flora Mexicana* (*Erythrina Crista Galli*).

How long the party stayed in San Salvador I do not know; judging from the pattern set in their previous excursions, and by the date of the first salary-receipt they signed in León, Nicaragua (31 May 1797), it seems likely that they travelled to Nicaragua in May, after a few weeks at their base in San Salvador. From the citations in the Flora of Guatemala it appears they travelled overland as far as San Miguel, but their next recorded locality to the southeast is in northern Nicaragua, on the other side of the Gulf of Fonseca. Perhaps they crossed the Gulf in a boat; at any rate we pick up their trail again near the port of Realejo, whence they described at least 5 species; from the nearby mountains of El Viejo and Chinandega they described some 10 species. From León itself some 35 species are listed; 2 of these appear in the *Flora Mexicana.* Of their travels beyond León little is known; they seem to have made their headquarters in the city for at least six months (the last salary receipt is dated 2 Dec 1797). Sometime during this period they must have made at least one trip as far southeast as the Gulf of Nicoya, in what is now Costa Rica. The principal localities along this route, as cited in the Flora of Guatemala, were Nagarote, Mateare, Managua, Masaya, and Granada and the surrounding mountains, indicating a stop of at least some days in this general region between Lake Nicaragua and the coast. About 50 additional species are cited simply as from "Nicaragua." Granada was an important city, the terminus of the water-route across Lake Nicaragua, and it seems likely that it was also effectively the southern terminus of Mociño's excursion, as it had long been the terminus of the road from Guatemala. In the Flora of Guatemala, however, there are a few citations indicating that some or all of the party reached a point some 350 kilometers further southeast. There is at least one reference to Cartago ("Cartaginis montibus") and at least four to Nicoya ["Nicoyae montibus," "littora versus Nicoyae," "sinum Nicoyae"].

Of the return to Mexico little can be added to Rickett's account (Rickett, pp. 37–38). The journey occupied an entire year; its stages are documented in AGH

465[14]: 8–11, and by Arias (pp. 197, 199). Mociño and Cerda were in San Salvador on 12 Feb 1798; in Cojutepec on 26 Feb; in Guatemala on 31 Mar, 10 Apr, and 9 May; in Ciudad Real on 6 Jul, 29 Aug, 7 Oct, and 10 Dec. In this last place Mociño asked and was granted permission to stay and put his medical skill at the service of that community which had been plagued by an outbreak of leprosy. Cerda must have left Chiapas soon after the 10th of December, as he arrived in Mexico on the 24th of the same month. Mociño drew his salary in Tehuantepec on 31 Dec 1798, and reached the capital 3 Feb 1799.

The botanical results of the trip to Central America seem pitifully meager. Had the Flora of Guatemala been published in the early years of the 19th Century it would have been a classic in spite of its deficiencies. As it is, we know that the Expedition travelled in Central America; we have a few specimens in the Sessé and Mociño herbarium that surely were collected there (e.g. *Eugenia pachychlamys,* a Guatemalan endemic); a few species described by DeCandolle and his contemporaries (e.g. *Couroupita nicaraguarensis, Werneria mocinniana*); a few additional paintings in the DeCandolle collection, bearing unpublished names indicative of a Central American origin; and the fewer than 15 references to Central American species in the *Flora Mexicana.* Botanists of the future, if working with the collections of Sessé and Mociño, either in the original set at Madrid, or among the duplicates distributed by Pavón, will do well to remember, however, that any individual specimens of unknown origin may have been collected in Guatemala, in El Salvador, in Nicaragua, or even in Costa Rica.

Mexico, 1799–1803

Active botanical collection by the members of the *Expedición Botánica* seems to have ended with Mociño's return from Central America. One cannot discount the possibility of occasional casual collections near Mexico City, but I have seen nothing in the form of notes or comments in letters to substantiate this. As Rickett notes, the period from 1799 to 1803 was one of arrangement of collections, of sorting, classifying and naming of specimens; perhaps the final enumeration of the paintings and the herbarium was begun at this time; we do not know. Sessé was occupied for a part of the time with a lawsuit. Mociño found himself in financial straits; on 9 Nov 1799 (AGH 465[14]: 14–15; Mociño to Azanza, Mexico) he notified the Viceroy that he could not even afford to buy the "papel sellado," the regular vehicle used for official correspondence. Perhaps because of the difficulty of settling the affairs of the trip to Guatemala, and of obtaining the salaries due him, Mociño turned to medicine, with which he must have been completely occupied for the last two or more years of his stay in Mexico (cf. Rickett, pp. 38–39).

On the eve of the departure for Spain (Rickett, pp. 72–75), Sessé made a strenuous effort to enable Mociño to accompany the others, so he could help in the completion of the projected flora. Sessé also urged that Cerda accompany the Expedition to Spain, and that Echeverría (who be it remembered had joined the Conde de Mopox y Jaruco) be ordered to rejoin the *Expedición Botánica* in order to help with the completion of the paintings, of which 2000 were only partly finished, and about 400 in rough draft. The upshot of all this was that Cerda was ordered to remain with the Botanical Garden in Mexico (AGH 465[14]: 9. 16 Jan 1803, quoted by Rickett, p. 74), but Mociño and Senseve made the journey to Spain, as did Sessé and his family and servants. Echeverría made his way independently to Europe, where he enjoyed a salaried appointment from 1803 to at least 1808 (Wilson, pp. 275–277).

The best account of the Expedition's return to Spain is given by Wilson (pp. 268–281), and most of the following is based on her data derived from official sources in Madrid.

Sessé and his party seem to have left Mexico in mid-March, 1803. He was in Jalapa at least from 17 Mar to 27 Mar (AGH 465[19]: 3, 4, 10–11), while Mociño was delayed in the capital at least until 21 Mar (AGH 465[20]: 1). Sessé petitioned to be allowed to go first to Havana (rather than directly from Veracruz), in order to pick up his Cuban and Puerto Rican collections left there five yeras before. Originally it was intended that Senseve and a servant should go directly to Spain with the collections from Mexico, and that Mociño should accompany Sessé to Havana, but in fact it was Mociño who sailed directly to Spain, arriving in the port of Cádiz on 31 Jul 1803 after a voyage of 57 days; presumably, therefore, he left Veracruz about 5 May.

Sessé was delayed in Havana by rumors of a new rupture with England, and did not reach Cádiz until early in November 1803 (Sessé to Caballero, Cádiz, 8 Nov 1803, quoted by Wilson, p. 273). He brought with him one box containing the most valuable manuscripts and drawings; the remining 26 boxes, presumably left in the care of Senseve, did not arrive in Madrid until 12 Jun 1804 (Sessé to Caballero, Madrid, 13 Jun 1804. Wilson quotes Sessé as writing: "por fin llegó ayer D^{n}. Jayme Senseve con los 26 caxones de Herbario y otros objetos de Historia Natural.")

INDEX TO LOCALITIES

The index is intended to include all American localities mentioned on specimens in the Sessé & Mociño herbarium, cited in the unpublished "Flora of Guatemala," mentioned in the *Plantae Novae Hispaniae* and the *Flora Mexicana,* or otherwise known or thought to have been visited by Sessé, Mociño, or the other botanists of the Botanical Expedition. No attempt has been made to list the localities visited by Longinos Martínez, as his botanical contribution seems to have been minimal, and his itineraries have been described in detail by Simpson (1961).

Each locality-name is referred to some major political subdivision, if this is known. A large majority of all the names represent localities in Mexico, and these are followed by the appropriate abbreviations for the names of States (estados), or that for the Distrito Federal (D.F.). Localities in other countries are identified by the abbreviations for California (Calif.) or Puerto Rico (P.R.), or by the names of the countries (or, for one locality, that of the State of Alaska) written in full. Names of the states and countries are all in square brackets, indicating their relationships to modern countries or their subdivisions, not to political boundaries mentioned by Sessé and Mociño.

For each locality the coordinates of latitude and longitude, if known, are given to the nearest minute. An asterisk following the figures for latitude and longitude indicates that the data were taken from the gazetteers published by the United States Board on Geographic Names. Other figures were taken from the sheets of the Map of Hispanic America 1: 1,000,000, published by the American Geographic Society, or in a few instances from other maps cited in the text.

Some few places have disappeared since 1800, some have moved a few kilometers from their original sites, some have changed their names, and some have become swallowed up in large cities, especially in México. On the other hand a remarkably large proportion of the places visited by the botanists of the Expedition to New Spain have persisted and can be located without difficulty.

The date or dates at which each locality was visited are given as far as this can be done. Since the Expedition had its headquarters in Mexico City for more than 15 years, it is not possible to give dates for visits to the more accessible localities within 50–75 km from the capital, unless such dates have been specifically mentioned in correspondence or otherwise. It should be noted that there are two general checks upon dates, aside from archival mentions: Localities cited in *Plantae Novae Hispaniae* were necessarily visited before mid-July, 1791, as at that time the manuscript of that work was dispatched to the Viceroy from Guadalajara. Localities cited in *Flora Mexicana,* however, cannot be dated in any such manner, but only by association with other localities that are known to have been visited on certain dates. Thus Metepec, to which there are references both in *Plantae Novae Hispaniae* and *Flora Mexicana,* is presumed to be either near Mexico City or south or west of that place, because by the time of completion of the manuscript of *Plantae Novae Hispaniae* the exploration of the Atlantic slope toward the southeast had not yet begun. A second, and relatively minor but occasionally significant way of dating plant-descriptions and specimens, is available because one of the active botanists, Castillo, died in 1793. Some specimens in the Sessé & Mociño herbarium, and some notes and other manuscripts are written in his very distinctive handwriting, thus providing evidence of a kind as to the date of these inscriptions.

The abbreviations FGU, FM, and PNH, used throughout the index to localities, refer respectively to the unpublished "Flora of Guatemala" written by Mociño, to the *Flora Mexicana,* and to the *Plantae Novae Hispaniae.* The first and second editions of the two latter works are identified in the text as necessary. Variant spellings are frequent in all the above works, and these have been cross-indexed as far as possible.

Both Mociño and Sessé seem to have written Latin acceptably; Mociño probably wrote it fluently and easily. Most of the expressions used in the published *Flora Mexicana* and *Plantae Novae Hispaniae,* and the unpublished "Flora of Guatemala," are readily understandable by anyone who has a Latin dictionary at hand. The meanings of such words as *montibus, frigidissimis,* and *litora maris* are almost self-evident. The non-Latin reader must remember that nouns, including place-names, seldom appear in their nominative forms. Plants may be said to occur, e.g. "in calidis Acaponetae," that is *in* the hot regions *of* Acaponeta. Here the noun preceded by *in* takes the ablative case, and the place-name is in the genitive. Mexican names ending in *-tán* or *-tlán* may be written with the ending *-tam* or *-tlam,* or *-tani* or *-tlani,* depending upon the case. Names like Acapulco or Ahualulco, may appear as Acapulcum or Ahualulci. Sometimes the authors seem to combine Latin and Spanish, as in the expression "in clivo de Maltrata." Sometimes the place-name assumes an adjectival form, as e.g. "in aqueductibus Quahunahuacentibus" (in the Cuernavacan aqueducts), or "itinere Sanctuarii Chalmensis"; that is, "on the way to the Sanctuary of Chalma." Not infrequently, especially for localities in or near Mexico City, Sessé and Mociño refer to the place in terms of its inhabitants, e.g. "in Mexicanorum Aquaeductum marginibus," i.e. "along the margins of the aqueducts of the Mexicans"; the "Mexicans" in this instance are those who live in Mexico City, that is, México.

A few much-used words may be explained for the benefit of the reader who is dependent upon a dictionary of classical Latin. Sessé and Mociño seem to have used them about as follows:

anfractus (gen. sing. *anfractus,* abl. sing. *anfractu,* abl. pl. *anfractibus*). Literally a turning, a bending, a tortuous, circuitous route. As used in FM and PNH the word seems usually to refer to localities near which there are the deep, steep, rocky stream-valleys commonly called *barrancas,* e.g. "in anfractibus Guadalaxarae vicinis." As the city of Guadalajara lies on a plain, there is no obvious place where plants would be found "in anfractibus" unless it might be along the tortuous mule-paths descending into, and crossing, the nearby *barrancas.* In another place the text refers to "aridissimis profundissimisque anfractibus," in a region in Hidalgo where deep *barrancas* are noteworthy.

clivus (abl. sing. *clivo,* abl. pl. *clivis*). Literally a hill, often a gentle hill. Sessé and Mociño seem to have used it as a way of contrasting lower or more isolated hills, with mountain ranges; they used the word *mons* (montis, montibus) mostly for what in Mexico would be called *sierras,* and *clivus* for what would be called *cerros.*

haereditas (or *hereditas*) (gen. sing. *haereditatis,* abl. sing. *haereditate*). Literally "heirship" or inheritance. Sessé and Mociño used it to mean an *hacienda,* a privately owned country place of some size and population, as distinguished from a *pueblo,* a real town, which they called *oppidum.* They also used *haereditas* as more or less synomymous with *praedium*; for example, they referred in one place to "Temisci praedio," and in another to "Temisci haereditate."

oppidum (gen. sing. *oppidi,* abl. sing. *oppido*). Originally any town (except Rome, which was called *urbs*). Sessé and Mociño used *oppidum* for populated places both small and large; they also used *urbs* (gen. sing. *urbis*) occasionally for the larger places, evidently exactly as we would use the word "city."

praedium (gen. sing. *praedii,* abl. sing. *praedio*). Originally a farm, estate, or manor. In Mexico and other parts of Spanish America, the best approximation is probably *hacienda*; see also *haereditas.*

Acahuizotla, [Gro.] 17°23′ N., 99°27′ W.*

About 20 km S of Chilpancingo, on the Pacific slope; variously spelled in PNH and FM, as "in Acahuyzotlae montibus," "Acauizotla versus Acapulcum." Visited during the "Second Excursion," summer and fall, 1789; see text, p. 128.

Acaponeta, [Nay.] 22°30′ N., 105°22′ W.*

The reference in FM is "in calidis Acaponetae"; visited by the botanists of the "Third Excursion" during the autumn of 1791; see text, p. 133.

Acapulco, [Gro.] 16°51′ N., 99°55′ W.*

Visited in the autumn of 1789, during the "Second Excursion"; see text, p. 129. Variant spellings include "in Acapulzi hortis" (PNH ed. 1, p. 127).

Acatlipa, [Mor.] 18°49′ N., 99°14′ W.*

About 15 km S of Cuernavaca, and presumably visited first during the "Second Excursion" in 1789; see text, p. 128. The reference in PNH is "in . . . Acatlipae hortis umbrosis."

Acayucan, [Ver.] 17°57′ N., 94°55′ W.*

Mociño presumably passed through here in the autumn of 1793, on the inland route between San Andrés Tuxtla and Coatzacoalcos. In FM there are at least 14 references to e.g. "in Acayucae . . . montibus," "in Acayucae circuitibus." In the S. & M. herbarium *Aeschynomene americana* bears the epithet *acaiucense.*

Achichipico, [Mor.] 18°56′ N., 98°49′ W.*

About 7–8 km NE of Yecapixtla. Probably visited in 1788 and 1789; see text, p. 125. This is presumably the place cited in FM, as follows: "in oppido de Chichipilco, inter Amecameca et Ayacapixtla." It is spelled Achichipilco, on Carta Rep. Mex. 1/100,000, hoja 19-I-S.

Agasonum, [Chis.]

Not located; see Comitán.

Aguadilla, [P.R.] 18°26′ N., 67°09′ W.*

Presumably visited in May or June 1796; see text, p. 144. References in FM are, "in montibus del *Rincón* et Portum de la *Aguadilla* interjectis"; "ad litora maris arenosa inter portum de Cabo Rojo et Aguadillam, Insulae de Porto Rico"; and "in monticulo *Porto de la Aguadilla* vicino."

Aguascalientes, [Ags.] 21°53′ N., 102°18′ W.*

Rickett (p. 29) describes the visit of Mociño and Castillo to this place in 1791; see also text, p. 133.

Ahuachapán, [Salvador] 13°55′ N., 89°51′ W.*

See Salvador; cited in FGU.

Ahualulco, [?Tab.] ?ca. 18°18′ N., 93°50′ W.

In FM there are about 50 references to this place, e.g. "in Ahualulci sylvis" ["unbrosis humidis," "montibus"]. *Pterocarpus mexicanus* is said to occur "in Tuxtlae atque Ahualulci montibus," and the next species in the text is said to occur "cum praecedentibus ad litora maris." Sprague (1926, p. 423) supposed Ahualulco (or Agualulco) to be in Jalisco, but this is unlikely (see text, p. 142). The composition of the flora, the name *tabascense* applied to species from this locality, and its position on the seashore (see above), all indicate that the Ahualulco of Sessé and Mociño was in Tabasco.

Ahuijullo, [Jal.] 19°03′ N., 103°05′ W.

About 25 km W of Tepalcatepec, Mich., but separated from that place by what

Sessé & Mociño called the "montibus inhospitalibus" on the divide between the Río Tepalcatepec and the Río Coahuayana. The "Third Excursion" passed through here in Jan 1791, enroute from Apatzingán, q.v., to Coahuayana. In PNH a reference is "in montibus Haereditatis Ahueiyuo." In PNH and FM the name is also misspelled "Ahuehuio," "Ahuejuyo," and "Ahuesuyo."

Aibonito, [P.R.] 18°08′ N., 66°16′ W.*

This is apparently the place cited in FM as Saibanito ["in Praedio de Josefo Garcia juxta iter de Toa Alta ad Saibanito interjectum"], or Saibonito ["in anfractu de Saibonito haud procul a Praedio Domini Colon in Insula de Porto Rico"]. Urban (Symb. Antill. 4: 666. 1911) equated these names with Aibonito. Apparently Sessé passed through here in May or June, 1796, on his way to the south shore; see Puerto Rico, or text, p. 144.

Alamos, [Son.] 27°01′ N., 108°56′ W.*

The botanists and artists of the "Third Excursion" drew their salary at "Real de los Alamos" on 21 Oct 1791; see text, p. 132.

Alfajayuca[n], [Hgo.] 20°25′ N., 99°21′ W.*

About 15 km SW of Ixmiquilpan. Sessé and Castillo worked here, probably in August, 1792. See Hidalgo. In FM spelled Alfaxajuca, or Alfajaiuca.

Alvarado, [Ver.] 18°46′ N., 95°46′ W.*

On the Atlantic coast about 60 km SE of Veracruz. Cited in FM as "Alvaradi," "in Albaradi litore," or "ad Alvaradi fluminis ripas." Mociño went more than once between Veracruz and San Andrés Tuxtla in the autumn of 1793, and stopped at least once near the mouth of the Río Alvarado; see text p. 141.

Amatitán, [Jal.] 20°50′ N., 103°43′ W.*

About 15 km SE of Tequila. The "Third Excursion" passed through here, probably in August 1791, enroute from Guadalajara, q.v., to Tepic. References in FM are "in Amatitani clivo," and "in agris Amatitlani [sic]."

Amatlán, [Ver.]

This locality is cited by Sprague (1926, p. 423), but I do not know the basis for the report. Possibly he meant Santa Ana Amatlán, q.v.

Amecameca, [Méx.] 19°07′ N., 98°46′ W.*

This place lay on the way to the "tierra templada" of Yecapixtla and Xochitlán, where the "First Expedition" worked in 1788, and where the botanists returned later; see text, p. 126. One reference in PNH is "in Amecamecae Sacromonte."

Angelopolis: see Puebla.

Antigua, [Guatemala]: see Guatemala. 14°34′ N., 90°44′ W.*

Antigua, [Ver.] 19°20′ N., 96°18′ W.*

The "old city" of Veracruz, about 25 km NW of the present city. Either Sessé or Mociño could have collected there; see Veracruz, Estado. In the S. & M. herbarium, *Croton cortesianus* is labelled by Sessé "prope Antiguam"; *Samolus ebracteatus* is "in litora maris prope Antiguam."

Apam, [Hgo.] 19°43′ N., 98°25′ W.*

In southernmost Hidalgo, between 20 and 25 km NE of Calpulalpan, q.v. The reference in PNH is "in Apae aequoribus."

Apastepec, [Salvador] 13°40′ N., 88°47′ W.*

See Salvador. In FGU a locality cited as on the road "a Servatoropoli versus

Michaelopolin duccente," "tribus quatuorve leucis ab Oppido Apastepeque." The locality is in fact less than 5 km N of San Vicente.

Apatzingán [Mich.] 19°05′ N., 102°15′ W.*

In the S. & M. herbarium at least 2 specimens, *Echites parviflora,* and *Grislea herbacea,* are labelled as from Apatzingán. There are about 140 species cited in PNH from southwestern Michoacán, including Apatzingán, where the "Third Excursion" spent about two months, Oct-Dec 1790; see text, p. 131. They came from Morelia, via Pátzcuaro, Tingambato, Uruapan and the cataract of Zararacua, Ario, and Jorullo. On leaving Apatzingán, they followed the main road to San Juan de los Plátanos, Santa Ana Amatlán, Tomatlán, Tepalcatepec; they crossed the mountains west of the last place, and followed the Río Ahuijullo down toward Coahuayana.

Arecibo, [P.R.] 18°28′ N., 66°43′ W.*

Probably visited in early summer, 1796; see Manatí, and see text, p. 144. The reference in FM is "in montibus del Arecibo."

Argueta, [Guatemala] 14°49′ N., 91°14′ W.*

About 10 km NW of Sololá; see Guatemala. References in FGU include "Arguetae praedio prope Totonicapanenses montes."

Ario, [de Rosales, Mich.] 19°12′ N., 101°43′ W.*

The "Third Excursion" passed through here, probably in early October 1790, enroute from Morelia to Apatzingán, q.v. The place is cited in PNH, e.g. "in oppido Ario."

Arroyo Frío, mountains

A locality cited in FM (ed. 2, p. 186): "in montibus de *Arroyo frio*." Not located; probably somewhere in Mexico or Central America.

Astillero, volcano or praedium, [Jal.]

See Guadalajara. Also spelled Hastillero. The name Astillero persists in the area 30–60 km W of Guadalajara. The modern Santa Cruz del Astillero is about 30 km WNW of the city, near the old (and modern) road to Tepic, which the "Third Excursion" travelled in July, 1791. The Carmelite Convent ("Praedium . . . Astillero dicto"), which was occupied until the middle of the 19th Century, was about 60 km W of the city, near present Teuchitlán.

Atohuilco, [hot springs of]: see Atotonilco.

Atotonilco, [Gto.] ca. 20°59′ N., 100°47′ W.

The site of well-known hot springs about 10 km NW of San Miguel de Allende. The "Third Excursion" passed through enroute from Querétaro, q.v., to Guanajuato, probably late in June 1790. The reference in FM is "ad thermas Michaelopolitanas, vulgo dictas Atotonilco." In PNH the reference to the same species gives the locality as "ad thermas de Atohuilco, Michaelopoli vicinas." The locality is cited by Sprague (1926, p. 423) as Atatonilco.

Atotonilco el Grande, [Hgo.] 20°17′ N., 98°40′ W.*

About 20 km NNE of Pachuca. Sessé and Castillo worked here in ?September 1792. See Hidalgo, and Santa Mónica.

Australis Oceani littore: the Pacific Ocean; see Coahuayana.

Ayacapistla (Ayacapixtla): see Yecapixtla.

Ayahualtempa, [Gro.]

Not precisely located. There are more than 20 references to this place in PNH

and FM, including "in Ayahualtempam prope Chilapam," and mention of "montibus frigidis" in the vicinity. Sessé was in "Aiahualtempa" on 30 Aug 1789, and in Chilapa with the others of the "Second Excursion" on 2 Sep; see text, p. 128. Another spelling is Ayahuatempa.

Azacualpa, [Guatemala] 14°14′ N., 90°06′ W.

About 25 km NW of Jalpatagua, as shown on sheet ND 15, Amer. Geog. Soc. Map of Hispanic America. The name is missing from many modern maps of Guatemala. It was cited in FGU as Zacualpa. See Guatemala.

Borcalem, [Nicaragua]

Not located; in FGU the reference is "Nicaraguensibus montibus versus Borcalem Provinciam Segoviam adpelatur."

Brito, [Nicaragua] 11°21′ N., 85°59′ W.

In the narrow strip of land between Lake Nicaragua and the ocean, about two-thirds of the way from Granada to the Costa Rican border; see Nicaragua. The reference in FGU is "Nicaraguae montibus versus Portum de Brito vulgo adpelatur."

Bucareli, Puerto de, [Alaska] 55°14′ N., ca. 133°30′ W.

See Nootka, and text, p. 136. Maldonado accompanied Jacinto Caamaño in the *Aranzazú* in the summer of 1792. Leaving Nootka on 13 Jun, they reached the entrance to Bucareli Bay on 24 Jun, and anchored next morning off San Antonio, which port was on a small island (Baker Is.) adjacent to the larger bay. The "port" of Bucareli was in a good natural harbor on the west side of Prince of Wales Island; it was first named by Bodega y Quadra in 1775, in honor of the then Viceroy of Mexico. Maldonado accompanied a party that explored the entire harbor and the surrounding islands for 10 days. He compiled a list of the plants found on the trip; this was published in full by Arias (p. 412), and in English translation with some proposed Latin equivalents by Wagner & Newcombe (1938, pp. 209–210). The *Aranzazú* left Bucareli in mid-July, and reached Nootka on 8 Sep, having spent the intervening time exploring the coastal waterways between the two places. Caamaño's journal of this summer has been rendered into English (Wagner & Newcombe, 1938), and a detailed account of his voyage is given by Wagner (1937, cf. pp. 377, 407), and by Cook (1973).

Cabeza, La, [Nicaragua]

Not precisely located. In FGU the references are "non procul a [illegible word] in Praedio dicto La Cabeza," and "La Cabeza Granatum inter et Nicarabuam." The City of Nicaragua is the modern Rivas (11°26′ N., 85°51′ W.*), about 60 km south of Granada. See Nicaragua.

Cabo Coco: probably a misprint for Cabo Rojo, q.v.

Cabo Rojo, [P.R.] 18°05′ N., 67°09′ W.*

Probably visited by Sessé during the early summer of 1796; see text, p. 144, and see Aguadilla, and Puerto Rico.

Caguas, [P.R.] 18°14′ N., 66°02′ W.*

Probably visited by Sessé during the late summer of 1796; see text, p. 144, and see Puerto Rico. The reference in FM is "in loco de Caguas Insulae de Puerto Rico."

California: see Monterey.

Calpulalpan, [Tlax.] 19°35′ N., 98°35′ W.*

About 60 km ENE of Mexico City. Also spelled Capulalpa and Calpulalpam. In FM there are references to the road between Texcoco and Calpulalpan, and between

the latter and San Martín de Texmelucan. In PNH there is a reference to Apam, which is NE of Calpulalpan. Probably the botanists of the expedition came this way on more than one occasion, over the relatively easy terrain from México.

Campana, La, praedium, [P.R.]

Not precisely located; presumably an hacienda not far from Río Piedras, q.v.

Camuy, [P.R.] 18°29′ N., 66°51′ W.*

On the north shore of Puerto Rico about 15 km W of Arecibo. Probably visited by Sessé in May or June, 1796; see Puerto Rico, and text, p. 144. The reference in FM is "in anfractibus inter Oppidum de la Tuna et Praedium de Camuy."

Canelas, Puerto de, [Dgo.] ca. 25°10′ N., 106° W.

Also mentioned as "Puerta de Canoas." Sessé stated that Mociño and Castillo crossed the Sierra Madre by this pass, after visiting Alamos, Sonora, in order to explore Nueva Vizcaya [i.e. Durango]; see text, p. 133. Rickett, quoting Mociño in An. Ci. Nat. [Madrid] 7: 214. 1804, mentions the crossing of the "frigidísima serranía de la Tarahumaria alta" by way of "Puerta de Canoas." In spite of the modern connotation of "Tarahumaria," which would suggest a crossing of the Sierra in Chihuahua, I think Mociño and Castillo must have back-tracked as far as Culiacán. I find no written record that a regular road from Culiacán to Durango existed in 1791, but by 1850 (cf. Alvarez & Duran, 1856, p. 386) the road was well established. It ascended the valley of the Río Tamazula-Topia as far as Canelas (ca. 25°06′ N., 106°34′ W.), then crossed the divide about 50 km farther east (i.e. some 40 km SW of Tepehuanes) before turning southeastward to Durango.

Cangrejos, [P.R.]

Not precisely located, but presumably on the north shore of the island, not far from San Juan. Sessé probably visited here late in the summer of 1796; see Puerto Rico, and text, p. 144. The references in FM are "ad litora maris de *Palo seco* et Cangrejos, Insulae de Puerto Rico," and "[iter?] ex oppido de Cangrejos ad Predium de Ingenio Viejo decurrentibus." Most modern maps fail to show any settlement called Cangrejos, but many indicate a Punta de Cangrejos, about 15 km E of San Juan (ca. 18°28′ N., 66° W.), and a place called Palo Seco 1–3 km SW of San Juan, across the harbor. Ingenio Viejo I have not located.

Canoas, Puerta de: see Canelas.

Cardonal, [Hgo.] 20°37′ N., 99°07′ W.*

Almost 25 km NE of Ixmiquilpan. Sessé and Castillo worked here, probably in August, 1792; see Hidalgo. From this place they presumably continued eastward to San Juan Amajaque; cf. a reference in FM: "in aridissimis profundissimisque anfractibus inter oppidum del Cardonal et S. Joanem de Amajaque."

Carmelitarum Eremus: see Desierto de los Leones.

Cartago, [Costa Rica] 9°52′ N., 83°55′ W.*

There is one reference to Cartago in FGU; this may mean that Mociño visited this part of Costa Rica, q.v., in the summer or autumn of 1797; I know of no reason why he should have undertaken such a long journey from his base at Granada, to which he returned at least by November of the same year. See text, p. 148.

Cerro, Oppidum del, [Cuba] 23°06′ N., 82°23′ W.*

In the urban area of Havana, slightly SW of the central city. In FM the reference is, "in Oppido del Cerro, Havanae vicino." See Havana.

Chacalapa, [Mich.] 18°45′ N., 103°40′ W.*

About 12 km NE of Coahuayana, q.v. The reference in PNH is "prope Coahuayanam, in praedio *Chacalapa.*"

Chalma, [Méx.] 18°55′ N., 99°25′ W.*

See Cuernavaca. The reference in PNH is "in clivo vulgo *Toto* dicto itinere Sanctuarii Chalmensis" (ed. 2, p. 80, corrected from "Charmesis" in ed. 1, p. 86). The famous sanctuary of Chalma is not far west of Cuernavaca, but practically inaccessible from that side because of the intervening barrancas.

Chapala, [Jal.] 20°18′ N., 103°12′ W.*

On the north shore of Lago de Chapala, about 45 km SE of Guadalajara. The "Third Excursion" passed through here, in February or March 1791, enroute from Colima to Guadalajara, q.v. In the S. & M. herbarium a species of *Euphorbia* bears the epithet *chapalensis.* Presumably the expedition came from Sayula around the western end of the lake and along the north shore to Chapala, cf. references in PNH, "in . . . temperatis Chapalici maris littoribus" (in PNH ed. 1, p. 96 this appeared as "Chalpalicimaris dittoribus"). References in FM are e.g. "prope Chapulam [sic]. Floret Februario," and "in Chapala prope parietes Eclesiae."

Chapalicum Mare: see Chapala.

Chapula: see Chapala.

Chapultepec, [D.F.]

The site of an ancient park, and a fortress on a prominent hill, now surrounded by the urban area, and hardly 5 km W of the center of Mexico City. Probably naturally enough, there are several references to it in PNH and FM: "Habitat Chapultepeci prope Mexicum area"; "in Nemore [or Colle, or Arce] de Chapultepec"; "inter rupes monticuli de Chapultepec."

Chapultepec, [Mor.] 18°54′ N., 99°13′ W.*

About 2–3 km E of Cuernavaca, q.v. Most of the references in PNH and FM are presumably to the place of this name in what is now central Mexico City, but in PNH, ed. 2, p. 84, the citation is "in Oppido Chapultepece prope Quauhnahuacam."

Charmesis: see Chalma.

Chiantla, [Guatemala] 15°22′ N., 91°27′ W.*

Ca 4–5 km NNE of Huehuetenango; see Guatemala. The reference in FGU is to "Chiantae [sic] petrosis." I take this to be a misprint for "Chiantlae," and suppose Mociño passed through on his trip to Guatemala.

Chiapa [de Corzo, Chis.] 16°42′ N., 93° W.*

See Chiapas, Estado, and San Cristóbal de las Casas. In FGU there are at least 17 references ("in Chiapae montibus, declivibus, plagis, in Chiapensibus hortis"). Formerly also called "Chiapa de los Indios"; see text, p. 147.

Chiapas, Estado

See Oaxaca. Mociño passed through Chiapas in Jun–Jul 1795 and again in Aug–Dec 1798, as indicated by citations in FGU. From Tehuantepec in 1795 he passed through Juchitán, Ocozocoautla, Tuxtla, Chiapa [de Corzo], Ciudad Real, Teopisca, San Bartolomé, Xocoltenango, Comitán, Zapaluta, and Escuintenango, thence into the territory of Guatemala, q.v. Presumably the return trip was by the same route. In FM there is a citation "in Comitani ac Civitatis Regiae circuitibus" (ed. 2, 174). In the S. & M. herbarium *Rubus* sp. bears the epithet *chiapensis; Croton niveus* is labelled "Copalchi de Tuxtla de Chiapa."

Chichipilco: see Achichipico.

Chilapa, [Gro.] 17°36′ N., 99°10′ W.*
The "Second Excursion" made a base here in the autumn of 1789; see text, p. 128. The place is about 35 km E of Chilpancingo. See Zitlala.

Chilpancingo, [Gro.] 17°33′ N., 99°30′ W.*
The "Second Excursion" spent some time here in the summer and autumn of 1789; see text, p. 128. The name was mostly spelled Chilpantzingo or Chilpanzingo by the botanists of the Expedition.

Chimaltenango, [Guatemala]: see Guatemala. 14°40′ N., 90°49′ W.*

Chinameca, [Salvador] 13°30′ N., 88°21′ W.*
See Salvador, and Michaelopolis.

Chinandega, [Nicaragua] 12°37′ N., 87°09′ W.*
Mociño appears to have come here by sea from the territory of El Salvador to the port of Realejo, then to have continued overland to León; see text, p. 148. In FGU there are references to "Chinandegae montibus prope Legionem," and "Chinandegae montibus versus Realexi portum."

Chorrera, Boca de la, [Cuba] 23°08′ N., 82°25′ W.*
See Havana. The reference in FM is "incolit litora de la Chorrera, non procul ab urbe Habanae." Another, with different spelling, is "in agris Chorrenae vicinis." The locality is now in the city, west of the harbor.

Chucandaro: see Chucándiro.

Chucándiro, [Mich.] 19°54′ N., 101°20′ W.*
The "Third Excursion" passed through here, probably late in July 1790, en route to Morelia. See Guanajuato, and text, p. 130. The citation in PNH is "in frigidis Chucandiri montibus." This place lies near the southwestern corner of Laguna de Cuitzeo.

Citacuaro: see Zitácuaro.

Citlata: see Zitlala.

Ciudad Real, [Chis.]: see San Cristóbal de las Casas.

Civitas Regia, [Chis.]: see San Cristóbal de las Casas.

Coaguayanae (or Coaguallanae) montibus (or maritimis).
In FGU there are 3 references to this place. Not located; presumably in Mexico. Conceivably these are references to Coahuayana, Mich., a locality often cited in PNH and FM.

Coahuayana, [Mich.] 18°44′ N., 103°41′ W.*
About 50 km nearly S of the city of Colima, and 10 km from the Pacific coast. The "Third Excursion" spent some days or weeks here and on the coast, probably in Jan 1791; see text, p. 131. They probably moved on toward Colima, q.v., early in February. In PNH cited variously, e.g. "in Australis Oceani littore prope Coahuayanam." Also spelled "Coaguayana," "Cuahuayana," "Quahuayana," and "Coohuayana." References in PNH and FM to "Mare Asiaticum," "littoribus [litoribus] Oceani Asiatici [or Australis]" are thought mostly to pertain to the shores near Coahuayana. In FGU there are 3 references to "Coaguayanae [or Coaguallanae] montibus [or maritimis]."

Coamo, [P.R.] 18°05′ N., 66°22′ W.*

Presumably visited by Sessé in May or June, 1796; see Puerto Rico, and text, p. 144. The reference in FM is "in calidioribus montibus de Coamo."

Coatzacoalcos, [Ver.] 18°09′ N., 94°25′ W.*

See Cozoliacaque, and text, p. 142. Apparently Mociño passed through here in 1793 or 1794, on his way to Tabasco, q.v.

Coinaoam: see Coyoacán.

Cojuca: see Coyuca.

Cojutepeque, [Salvador] 13°43′ N., 88°56′ W.*

See Salvador. Cited in FGU as "Coxutepec" or "Coxutepeque"; once cited "Coxutepequi ac Vincentopolis."

Colima, [Col.] 19°14′ N., 103°43′ W.*

The "Third Excursion" passed through here en route from Coahuayana to Guadalajara, qq.v., probably in February 1791. Citations in PNH include "in planis Colimae agris." See also Volcán de Colima ("prope Colimensem Vulcanum").

Colli, Volcán, [Jal.] 20°40′ N., 103°30′ W.

One of a series of ancient volcanic cones in the vicinity, Colli is about 20 km W of the center of Guadalajara, q.v. Presumably the "Third Excursion" passed this way after leaving Guadalajara late in July, 1791.

Comangilla, [Gto.] 21°04′ N., 101°29′ W.

The reference in PNH is "ad thermas . . . Comangillae prope Guanajuatum." Still a popular spa, the hot springs are between Silao and Leon, about 22 km SE of the latter. The botanists of the "Third Excursion" probably visited here from Guanajuato, q.v., in July 1790.

Comitán, [Chis.] 16°15′ N., 92°08′ W.*

See Chiapas, Estado, and San Cristóbal las Casas. In FGU there are several citations including "montium declivibus in Comitanensi via ad Agasonum stationem vulgo dictum Rancho Grande." In FM there is one reference.

Coohuayana: see Coahuayana.

Copalillo, [Gro.] 18°02′ N., 99°07′ W.*

About 50 km N and a little E of Chilapa, q.v. Probably visited by the "Second Excursion" in 1789. The reference in PNH is "in montibus de *Tlacotzotillam* prope iter del Copalillo."

Coquillo

The reference in FM is "in arenosis littoribus de Coquillo?" Presumably this is a corruption of Luquillo, q.v.

Córdoba, [Ver.] 18°53′ N., 96°56′ W.

Sessé seems to have made his headquarters here from mid-July to mid-October, 1793; see Veracruz, Estado. Mociño was here in late July, 1793, then left for Tuxtla, and other localities in southern Veracruz; see Veracruz, Estado. In FM various places near Córdoba are mentioned: "in praedio 'Ojo de Agua' prope Corduvam"; "in Praedio dicto Pozo del agua grande juxta Cordovam"; "in Praedio de *Tospa* aut S. José de la Laguna, juxta Orizava" (or "in Praedio Tospa juxta Cordovam"); "in Oppido S. Laurentii, juxta Cordovam." See these places. In the S. & M. herbarium at least 2 specimens are labelled as from "Cordova."

Costa Rica

Mociño appears to have made an excursion into this country, presumably from a base at Granada, Nicaragua, q.v., in the summer or autumn of 1797; in the unpublished Flora of Guatemala are several references to mountains or shores of Nicoya, to "sinum Nicoyae," and one reference to Cartago.

Coxquihuí, [Ver.] 20°11′ N., 97°35′ W.*

About 35–40 km SW of Papantla. Sessé and Castillo, about Oct 1792; see Veracruz, Estado. The reference in FM is "in calidissimis oppidis del Espinal et Coxquihui, ubi Totonaci Pog adpellant."

Coyoacán, [D.F.]

Now in the metropolitan area, about 10 km nearly S of the center of Mexico City. Also spelled Cuyuacan, or Quyaucan or (on Humboldt's map) Coyohuacan. One reference in PNH is "in Quyuacami saxetis." Sprague (1926, p. 424) listed Coyoacan, Cuyohuacan, Cuyuacan, and Quyaucan, presumably as different localities. Coinaoam (FM ed. 1, p. 7) was corrected (ed. 2, p. 6) to Cuyuacani.

Coyuca, [Gro.] 17°03′ N., 100°04′ W.

According to a florula prepared by Castillo (see text, p. 129), the botanists of the "Second Excursion" collected one species at a place called Cojuca, presumably near Acapulco. I take it that his locality was Coyuca de Benítez, about 25 km NW of Acapulco.

Cozoliacaque, [Ver.] 18° N., 94°37′ W.*

Sometimes spelled Cosoleacaque. Mociño prsumably passed through here in 1793, on the inland route between Acayucan and Coatzacoalcos. The reference in FM is "in Cozoliacaque prope Goatzacoalcum flumen." See text, p. 142.

Cuahuayana: see Coahuayana.

Cuahunahuaca: see Cuernavaca.

Cuahuayana: see Coahuayana.

Cuaximipilapa (or Cuaxinipilapa): see Quaxiniquilapa.

Cuba: see Havana.

Cuchumatanum montibus, [Guatemala] 15°35′ N., 91°25′ W.*

See Guatemala. In FGU are at least 29 references to these mountains. Also a reference "in frigidissimo Moscosi Praedio, prope Cuchumatanes Montes."

Cuernavaca, [Mor.] 18°55′ N., 99°15′ W.*

The "Second Excursion" made their headquarters here about from March to June, 1789. Many plants from here are cited in PNH and FM. The name is variously spelled; usually "Quahunahuaca," "in Quahnahuac (circuitibus, etc.)," "Quauhnahuacae," "Quahuanaca," sometimes "Cuahunahuaca." In FM (ed. 2, p. 128) there is a reference to "anfractibus de el *Toto* haud procul a Quauhnahuaca." In PNH the reference is "in clivo vulgo *Toto* dicto itinere Sanctuarii Chalmensis." Places visited along the road from México to Acapulco, via Cuernavaca, include Huitzilac, Tlaltenango, Xochitepec, Puente de Ixtla, Tepecoacuilco, and Chilpancingo.

Cuinchi, [hot springs of], [Mich.]

The reference in PNH is "prope Vallisoletum in thermis Cuinchi." The "Baños de Cointzio" (locally pronounced Cuincho) are about 10 km SW of Morelia, q.v.

Cuitzeo, Laguna de, [Mich.]

This is the large lake about 25 km N of Morelia, partly on the border between

Michoacán and Guanajuato. The "Third Excursion" passed the corner of the lake near Chucándiro, probably in late July or early August, 1790, en route from Guanajuato, q.v., to Morelia. The citation in PNH is "in arenosis Cuitzeensis Paludis agris."

Culiacán, [Sin.] 24°48′ N., 107°24′ W.*

Mentioned in Sessé's notebook of 1791; see text, p. 133.

Curacao

References in PNH are not to collections by Sessé & Mociño, but to citations by Linnaeus or others, e.g. *Verbena curassavica,* "in Mazatlan et Curassao."

Cuyohuacan, Cuyuacan: see Coyoacán.

Desierto de los Leones, [D.F.]

See México. Now a park, this wild area (Sp., *desierto,* an uninhabited place) was in the 18th Century the site of a Carmelite monastery, distant about 7 leagues from México. It is in fact about 20 km SW of the center, near the road to Toluca, in the fir forest. In PNH it is cited as Eremus P. P. Carmelitarum, or Mexicanorum Carmelitarum Eremus, or as Sanctus Eremus (or Heremus), i.e. the Holy Hermitage, or Monastery, of the Carmelite Fathers. The place was described by Gage (1958) as it was about 1625, and by Fanny Calderón de la Barca (1966) as it was 2 centuries later. See text, p. 126.

Durango, [Dgo.] 24°02′ N., 104°40′ W.

The botanists and artists of the "Third Excursion" drew their salary here on 2 Jan 1792; see text, p. 132.

El Valle: see Valle de Bravo.

In FM some references are e.g. "in montibus Oppido de *El Valle.*"

Eremus P. P. Carmelitarum: see Desierto de los Leones.

Escalante, [Nicaragua]

See Nicaragua. In FGU there is a reference to a species from "Nicaraguae littore ad Portum vulgo dictum Escalante." I have not located the port of Escalante. The Río Escalante runs to the sea [?] in ca. 11°31′ N., 86°10′ W., i.e. slightly northwest of Brito, which is also cited in FGU.

Escuintenango, [Chis.] ca. 15°50′ N., 92° W.

See Chiapas, Estado, and text, p. 147. In FGU there is a reference to "Escuintenango, Praedio de Salazar, Prov. Chiapas," and another, "montibus ab Escuintenango in Huistae [sic] Oppidum interiectis." This place has now entirely disappeared. It was described by Thomas Gage, who passed through it about 1625, as "one of the finest Indian towns of all the province of Chiapa." According to Thompson, who edited Gage's account (1958), Izquintenango (as Gage spelled it) was probably on the Río San Gregorio (a tributary of the Grijalva), a short distance west of the Guatemala-Mexico frontier.

Escuintla, [Salvador]: see Zacatecoluca.

Espinal, [Ver.] 20°16′ N., 97°24′ W.*

About 20 km SSW of Papantla. Sessé & Castillo, Aug–Oct 1792. In FM a reference is "in oppido de El Espinal ubi *Patzahumacachil,* totonaci dicunt." See Veracruz, Estado.

Fajardo, [P.R.] 18°20′ N., 65°39′ W.*

Probably visited by Sessé during the summer of 1796; see text, p. 144; also spelled Faxardo. In FM the references are "In montibus de Faxardo," and "Habitat pasim ex oppido de Faxardo ad civitatem de Puerto Rico."

Goatzacoalcos: see Coatzacoalcos.

The citation in FM is "in uliginosis Goatzacoalci sylvis."

Granada, [Nicaragua] 11°56′ N., 85°57′ W.*

In FGU there are almost 20 references to "Granata" ["Nicaraguensis"], indicating that Mociño spent some time there in 1797; see Nicaragua. *Lecythis ollaria,* with its source given as "in Granatae montibus," was published in FM.

Guadalajara, [Jal.] 20°40′ N., 103°20′ W.*

The "Third Excursion" was based here, probably for about 4 months (Apr–Jul 1791); see text, p. 132. After leaving Coahuayana, q.v., probably early in February, they came by way of Colima, Tonila, and the eastern foothills of the Nevado de Colima; passing Zapotlán, Sayula, and Chapala, they reached Guadalajara about 1 April. There are references in PNH to Guadalajara itself, including "in anfractibus Guadalaxarae vicinis," but nearby localities, e.g. "prope clivum vulcanicum del *Colli* juxta Guadalajaram," "prope vulcanum del Astillero haud procul ab urbe Guadalaxarae," and "in praedio P. P. Belemitarum Astillero dicto, prope Guadalaxaram," are mentioned only in FM; presumably plants from these places were collected too late for inclusion in the manuscript of PNH, which seems to have been completed in July. Leaving Guadalajara after 22 July, the expedition proceeded to Tepic, arriving before 13 August, and passing by Amatitán, Tequila, Hostotipaquillo, and presumably by Ahuacatlán and other localities mentioned in the text (p. 132). Longinos passed through Guadalajara in March 1791, only a short time before Sessé's party arrived from Zapotlán. There is no evidence that he met the other party in 1791 or 1793, either here or in Tepic; see text, p. 135. Presumably both Sessé (in 1792) and Mociño (in 1793) passed through Guadalajara on their return trips from Sinaloa and from San Blas, respectively. Sessé and his associates customarily used the spelling "Guadalaxara."

Guanabacoa, [Cuba] 23°07′ N., 82°18′ W.*

Now a part of the city, formerly 5–6 km east of Havana, q.v., across the harbor. References in FM include "Incolit aridos Guanabacoae agros." In the S. & M. herbarium a specimen of *Wedelia trilobata* is labelled "Guanavacoa." Other references in FM, mentioned under Havana, suggest that Guanabacoa was a distinct community in 1796–97.

Guanajuato, [Gto.] 21°01′ N., 101°15′ W.*

The "Third Excursion" was based here, probably about a month, in the summer of 1790; see text, p. 130. The name was variously spelled; in PNH (ed. 1) sometimes "Guanasuato," usually "Guanaxuato"; in ed. 2 sometimes "Guanajuato." From Guanajuato the expedition passed, probably in mid-July 1790, to Morelia (then called Valladolid) via Temascatío, Salamanca, Parangueo, Puruándiro, Huango, Chucándiro near the western end of Lake Cuitzeo, and Tarímbaro.

Guantánamo, [Cuba] 20°08′ N., 75°12′ W.*

Sessé worked in and near Havana, q.v., most of the time he was in Cuba in 1796–1798. There is a reference in FM, "in flumine de *Guantanamo* Insulae Cubae," which I cannot explain, as there seems to be no other evidence that Sessé and his party ever visited the eastern end of Cuba.

Guatemala

Mociño was in Guatemalan territory from about Sep–Dec 1796, and again on the return from Nicaragua from May–?Aug 1798. From the last outposts in Chiapas, q.v., he seems to have passed San Martín [Cuchumatanes], Santa Ana Huista, Huehuetenango, the Hda. [Praedium] Moscoso in the Cuchumatanes, Quezaltenango, Totonicapán, Argueta, Chimaltenango, Antigua, and Guatemala [City] (ca mid-Sep

1796). Leaving Guatemala [?Jan 1797] he passed Azacualpa, Jalpatagua, thence into El Salvador, q.v. Presumably the return trip was by the same route. Mociño was in Guatemala City 9 May 1798 and in Ciudad Real, Chiapas (q.v.) on 29 Aug. In the S. & M. herbarium the epithet *guatimalensis* [sic] appears on specimens named *Odontonema glabrum, Heterosperma pinnatum, Notylia trisepala, Colubrina ferruginea, Rubus* sp. In FM there are a few references, e.g. "in . . . calidis Guatimalae [sic] montibus," that apparently refer to the country, not to the city of the same name.

Guatemala [City, Guatemala] 14°38′ N., 90°31′ W.*

See Guatemala. Mociño was in the capital city at least by 14 Sep 1796, and probably departed for San Salvador in December 1796 or Jan 1797. On the return trip he arrived in the city probably in May 1798, and probably departed for Chiapas in August; see text, p. 148. In FGU there is a distinction made between "Nova Guatemala" and "Vetus Guatemala" [i.e. Antigua]; the latter is usually named as such, e.g. "montibus veteris Guatemalae," but the former may be a simply "Guatemala," e.g. "in montibus, ac oppido Passim in Veterem usque Guatimalam interiectis."

Guaximicuilapa: see Quaxiniquilapa.

Guista [or Guistla]: see Santa Ana Huista.

Hastillero: see Astillero.

Havana, [Cuba] 23°08′ N., 82°22′ W.*

Sessé, with Senseve and the artist Echeverría, was in or near Havana from the end of May 1795 until March 1796, and again from June 1797 until March 1798; see text, p. 143. Apparently he worked only in and near the city, especially along the coast west of the harbor as far west as Mariel, some 40 km from Havana. Localities in or nearly in the present city include El Cerro, Chorrera, Horcón (or Horticon), Castillo del Morro, the cave ("Antrum") of Tagarnana, and Jesús María. Guanabacoa, across the harbor and 5–6 km E of old Havana, is mentioned separately in FM, thus: "agros Havanam inter et Quanabacoam [sic] interjectos." Other references include: "in litore maris Havanae prope ambulacrum Sancti Lazari," "ad litora maris Habanae, prope *S. Juan de la Punta,*" "Havana in agro de Marte dicto"; "in suburbis Habanae juxta domorum parietes." About 35 specimens in the S. & M. herbarium are labelled as from "Habana" or "Havana," "in litore maris prope Havanam," or merely "Cuba." After their first stay in Cuba, the botanists made a protracted visit to Puerto Rico, q.v.

Heremus P. P. Carmelitarum: see Desierto de los Leones.

Hidalgo, Estado

Sessé, with Castillo, worked here Aug–Sep 1792, visiting (not necessarily in this order) Alfajayucan, Ixmiquilpan, Cardonal, San Juan Amajaque, Metztitlán, Santa Mónica, Atotonilco el Grande, and Tulancingo, whence they continued into Puebla. See Veracruz, Estado.

Horcón, [Cuba]

In the city of Havana, q.v. Perhaps the same as Horticon, q.v. The references from FM are "a margine suburbis del Horcon inter mangles," and "in suburbis del Horcon ad margines sinuns. [sic]." El Horcón is shown very near a western arm of the harbor, just south of Havana, on contemporary maps (e.g. No. 32, Cuaderno 3, Portulano de la América Setentrional, Madrid 1809, ed. of 1818).

Horticon, [Cuba]

Not located; presumably, from the following in FM, a place near the harbor of Havana: "in Havanae suburbis del *Horticon* dicta ad Bahiae margines paludosas." See Havana. Perhaps the same as Horcón, q.v.

Hortus Regius Mexicanus

References to this garden, or to "hort. Mex." or "hort. M." are to the Royal Garden established in Mexico City in 1788 with Sessé as Director, and Cervantes as Professor of Botany: see México.

Hostotipaquillo, [Jal.] 21°04′ N., 104°04′ W.*

About 35 km NW of Tequila. The "Third Excursion" passed near here, probably in August 1791, en route from Guadalajara, q.v., to Tepic. The several references in FM are all to the Hacienda de Santo Tomás, "near" Hostotipaquillo, e.g. "in Praedio S. Tomae justa Hostotipaquillo," or "in Praedio S. Thomae." Sprague (1926, p. 424) also notes the spelling Hostotpaquillo.

Huamantla, [Tlax.] 19°19′ N., 97°56′ W.*

About 35 km E of Tlaxcala. Not cited in PNH or FM, but in the S. & M. herbarium 3 specimens are labelled "in Huamantla" (*Aphanostephus*), "es Huamantleco" (*Grindelia*), and with the epithet "huamantlensis" (*Simsia*), respectively. The collector in each case may have been Ignacio León, for whom see p. 110.

Huango, [Mich.] ca. 19°59′ N., 101°24′ W.

Shown on old maps as about 8 km NW of Chucándiro, and 45 km NW of Morelia. The "Third Excursion" passed through here, probably late in July 1790, en route from Guanajuato, q.v., to Morelia. The reference in PNH is "in temperatis Huangi montibus," and in FM "prope Huangum in montibus." Also spelled "Huangui."

Huasteca, La

Sprague (1926, p. 424), cited "Huasteca, Ver.?," perhaps under the impression that the name referred to a specific locality. Presumably, however, the reference in FM ed. 2, p. 57, to "Tenampulco prope Huastecam," is to be translated "Tenampulco near *the* Huasteca." The region called La Huasteca has somewhat indefinite boundaries, but its principal extension is in the lowlands between the Sierra Madre Oriental and the Gulf of Mexico, from southern Tamaulipas to northern Veracruz and Hidalgo; cf. Meade, Joaquín, *La Huasteca* (378 pp., Editorial Cossio, México, 1942). There are various references to the region among the documents pertaining to the Botanical Expedition, but the botanists did not penetrate it any farther than along the southern edge, as e.g. at Tenampulco, and as far northeast as Papantla.

Huayapa, [Oax.] 17°06′ N., 96°40′ W.*

A place a few km NE of Oaxaca, missing from many modern maps. The reference in FGU is "Huayapae oppido prope Oaxacam." Presumably Mociño visited here in 1795 or 1798; see Oaxaca (Estado), Chiapas, Guatemala.

Hucitantenango, [?Gro.]

Not certainly located, but very likely the name is a corruption of Huecantenango (ca 17°30′ N., 99°07′ W.), a place about 20 km ESE of Chilapa. The reference in PNH (ed. 1, p. 131, ed. 2, p. 122) is "in pratis Hucitantenangi in Tlapae ditione." See Tlapa.

Huehuetenango, [Guatemala] 15°20′ N., 91°28′ W.*

See Guatemala. In FGU this is spelled Güegüetenango.

Huehuetla, [Pue.] 20°07′ N., 97°38′ W.*

Ca. 40 km ENE of Zacatlán de las Manzanas. Sessé and Castillo passed through here, Aug–Oct 1792; see Veracruz, Estado.

Huerta, La, praedium

Not precisely located; evidently near Toluca, q.v. The reference in FM is "in horto Praedii de la Huerta justa Tolucam."

Hueytlalpan, [Pue.] 20°02′ N., 97°42′ W.*

Ca 30 km ENE of Zacatlán de las Manzanas. Sessé and Castillo were here, Aug–Oct 1792; see Veracruz, Estado. In FM one reference is to "Oppidis S. Bernardi de Xochiatlam et Hueitlalpae"; another is to "oppido de Hueytlalpam."

Huichilachi montibus: see Huitzilac.

Huista [or Huistla]: see Santa Ana Huista.

Huitzilac, [Mor.] 19°02′ N., 99°16′ W.*

About 12–15 km NNW of Cuernavaca. The "Second Excursion" passed through here in 1789; see text, p. 128. The reference in PNH is "in frigidis Huichilachi montibus." The place was on the old road from México to Cuernavaca; cf. Alvarez & Duran (1856), who use the spelling "Huitchilac," and give the distance as 4 leagues from Cuernavaca, saying "desde Huitchilac descenso violento . . .". On older maps (e.g. that of Humboldt, 1810), the name is sometimes spelled Guichilaque.

Humacao, [P.R.] 18°09′ N., 65°50′ W.*

Sessé presumably visited here in the summer of 1796; see Puerto Rico, or text, p. 144. The reference in FM is "ad radices parietum Eclesiae de Tumacao"; evidently Tumacao is a misprint for Humacao, as pointed out by Urban (Symb. Antill. 4: 666. 1911). In another citation in FM the name is spelled "Tunaco."

Iacapixtla: see Yecapixtla.

Ingenio Viejo, [P.R.]: see Cangrejos.

Ixcuintla ["Yztcuintla"]: see Santiago Ixcuintla.

Ixmiquilpan, [Hgo.] 20°29′ N., 99°14′ W.*

Sessé and Castillo were here 2 Sep 1792; see Hidalgo. In the S. & M. herbarium a sheet of *Hechtia* sp. is labelled "de Yxmiquilpan."

Ixtacalco, [D.F.]

Now in the central urban area, about 5 km SSE of the center of Mexico City. The citation in PNH is "in Ixtacalco prope Mexicum."

Ixtapa ["Yxtapa"], [Chis.] 16°48′ N., 92°55′ W.*

Cited in FGU. This is presumably the place about 20 km E of Tuxtla Gutiérrez, on the way to San Cristóbal las Casas. See Chiapas, Estado.

Ixtapalapa, [D.F.]

Now well within the urban area, ca. 10 km SE of the center of Mexico City. In PNH and FM the references are to Ixtapalapa (or Iztapalapa) "prope Mexicum," or to the hill ("in colle" or "in clivo") near Ixtapalapa. This area was visited in the autumn of 1788, during the "First Excursion," and perhaps on the way to Amecameca and Yecapixtla.

Ixtla, [Gto.] 20°38′ N., 100°36′ W.*

The "Third Excursion" passed through here in June, 1790, en route from Querétaro to San Miguel de Allende; see text, p. 130, and Contr. Univ. Michigan Herb. 9: 309. 1972. The name is sometimes spelled Iztla or (in PNH ed. 2. 47), Ixtlac. Citations are "in Haereditate Ixtlae" or "in saxosis Ixtlae Haereditatis," near Querétaro.

Ixtla, Puente de, [Mor.] 18°37′ N., 99°20′ W.*

On the highway about halfway between Cuernavaca, Mor., and Taxco, Gro. In PNH the citation is "in calidissimis Ixtlae pontis agris." The "Second Excursion" presumably passed through here in the summer of 1789, en route to Acapulco.

Ixtlahuaca, [Méx.] 19°34′ N., 99°46′ W.*

About 30 km NW of Toluca. Sessé and Castillo presumably passed through here in the summer of 1792; see text, p. 138. The reference in FM is "in Pratis Sancti Antoni Oppidi jurisdictionis Ixtlahuacae."

Jalapa, [Ver.] 19°32′ N., 96°55′ W.*

See Veracruz, Estado, and text, p. 139. Sessé and Castillo were in Jalapa 2 Nov 1792, at the conclusion of a long trip. Sessé probably returned to Jalapa the next year, 1793. The locality is not cited in PNH or FM, but 5 specimens in the S. & M. herbarium are labelled as from there. The name is now officially spelled Xalapa.

Jalpatagua, [Guatemala] 14°08′ N., 90°01′ W.*

See Guatemala. Cited in FGU as Xalpatagua.

Jamaica

References in PNH are to citations by Linnaeus or others, e.g. *Verbena lapulacea,* "in Jamaica et prope Mexicum."

Jesús María, [Cuba] 23°05′ N., 82°25′ W.*

See Havana. The reference in FM is "in suburbio de *Jesus Maria* Havanae." The place is now in the city, southwest of the center.

Jorullo, [Mich.]

The volcano of Jorullo, which had erupted some years before, was visited by the "Third Excursion" in Oct 1790. It lies about 25 km a little E of S of Ario de Rosales (ca 18°59′ N., 101°43′ W.). The reference in PNH is "in montibus Xorullo vicinis"; see text, p. 131.

Juchitán, [Oax.] 16°26′ N., 95°01′ W.*

One reference in FGU; this is presumably the place about 25 km NE of Tehuantepec, on the road to Chiapas. See Chiapas, Estado.

Jucutacato, [Mich.]: see Uruapan.

Kamchatka: see Nootka.

"Lacu Mexicano," in: see México.

This is the Lago de Texcoco, the very shallow, shrinking basin that stretches some 25 km E and NE from the city of Mexico.

Laja, río, [P.R.]

The reference in FM is "ad margines fluminis de Laxa Oppidum de Toa Alta irrigantis"; see Puerto Rico, and text, p. 144. Some maps show a settlement called Río Lajas, 2–3 km WSW of Toa Alta. The Río Lajas is a small stream, about 10 km long, that comes in to Toa Alta from the west.

La Langosta, praedium

Not located; the reference in FM is merely "in Praedio Sacarino de la Langosta, Equitis D. Gonzalo de Herrera." The plant from this locality was *Milleria biflora.* A "sugar hacienda" may as well have been in Veracruz, or somewhere in the Antilles.

La Punta: see Punta.

Laureles, Los, praedium, [Mich.] 19°12′ N., 100°26′ W.

This is presumably the place by this name about 20 km S of Zitácuaro. It was visited by Sessé and Castillo, probably in August 1792; see Temascaltepec. The only reference in FM is relative to one species "in oppido Nandio et in Praedio de los Laureles."

Legio [León], [Gto.] 21°07′ N., 101°40′ W.*

Sprague (1926, p. 424) suggests that Sessé & Mociño used the name Legio to refer to the modern León, Guanajuato. There appear to be no references to León in PNH. Longinos (see text, p. 134) passed through León in Feb 1791, when almost nothing would have been in flower. I suppose the 2 references (to "Legione" and "Legionis") in FM pertain to species from Nicaragua, q.v.

Lempa, Río, [Salvador]

See Salvador, or text, p. 148. Mociño may have crossed the river about 15 km E of Zacatecoluca, or somewhat higher up, about 20 km E of San Vicente, on the regular road to Chinameca.

León, [Nicaragua] 12°26′ N., 86°54′ W.*

Mociño and his party reached León on their outward journey to Central America, in May, 1797, and probably worked in and near the city until mid-December 1797; see text, p. 148. See also Costa Rica. In FGU there are about 35 references to León ("Legionis," "Legione") (agris, suburbiis, campis, pratis, montibus); two of the species (*Scutellaria nicaraguensis* and *Hedysarum biarticulatum*) were published in FM.

Libreria, La, clivo de: see San Juan de Amajaque.

Loiza, [P.R.] 18°26′ N., 65°53′ W.*

Evidently near the north shore of Puerto Rico; cf. the reference in FM, "in litore maris prope Oppidum de Loisa." Shown on some maps as "Old Loiza," about 25 km E of San Juan. A newer settlement of the same name was built a short distance inland. Sessé visited "Loisa" late in the summer of 1796; see Puerto Rico, and text, p. 144.

Luquillo, [P.R.] 18°22′ N., 65°43′ W.*

Near the northeast point of the island, about 10 km NW of Fajardo. Sessé apparently visited here late in the summer of 1796; see Puerto Rico, and text, p. 144. The reference in FM is "in litore maris arenosa prope Oppidum de Loquillo." The names "Soquillo" (FM ed. 2, p. 77), and Coquillo (FM ed. 2, p. 15) are presumably corruptions of "Loquillo," i.e. Luquillo.

Malacatepec, [Méx.] 19°23′ N., 100°08′ W.*

Shown on old maps as about 20 km N of Valle de Bravo, 35 km E of Zitácuaro. Sessé visited here, probably in August 1792; see text, p. 138. References in FM include "in montibus de Malacatepec ad Zitacuarum interjectis." See also Valle de Bravo, and Temascaltepec.

Maltrata, [Ver.] 18°48′ N., 97°16′ W.*

About 20 km WSW of Orizaba, q.v., where Sessé worked in 1793. See text, p. 140. The reference in FM is "in clivo de Maltrata."

Managua, [Nicaragua] 12°09′ N., 86°17′ W.*

Mociño apparently spent some days in this vicinity in Spring or Autumn, 1797; see Nicaragua, or text, p. 148. In FGU there are at least 23 references to Managua; there is one published reference in FM. In the S. & M. herbarium *Croton niveus* is labelled by Mociño "Copalchi de Managua."

Manalme, [?Ver.]

Not located; apparently there is no place by this name in Mexico, and it may be a corruption of some better known name. The reference in FM (ed. 2, p. 67) is "in Tlacotalpam. Floret Junio. . . . Eadem in Manalme montibus. Floret Junio." This association with Tlacotalpan suggests that Manalme was near that place, on the coast of southern Veracruz. See Veracruz, Estado.

Manatí, [P.R.] 18°26′ N., 66°29′ W.*

Visited by Sessé, probably in June 1796; see text, p. 144. References in FM are "in aridis agris inter oppida de Manati et Naranjal dicta interpositis," and "in montibus inter Arecibo et Manati."

Mare Asiaticum: The Pacific Ocean; see Coahuayana.

Mariel, [Cuba] 22°59′ N., 82°45′ W.*

About 40 km WSW of Havana, q.v., on the north shore of the island; perhaps this was the western limit of Sessé's explorations in Cuba. References in FM are "in montibus del Mariel Insulae Cubae" and "ad litora maris in Porto de Mariel haud procul a Havana."

Masaya, [Nicaragua] 11°59′ N., 86°06′ W.*

In FGU there are at least 7 references to Masaya, including "montibus Masayam a Granata separantibus." See Nicaragua. Mociño presumably passed through here twice in 1797, between León and Granada.

Mateare, [Nicaragua] 12°14′ N., 86°26′ W.*

About 20 km WNW of Managua, between that place and León; see Nicaragua. Mociño presumably passed through twice in 1797. The reference in FGU is "Mateare inter et Nagarote Legionensia Oppidos."

Mazatlán, [Gro.] 17°27′ N., 99°29′ W.*

Visited by the "Second Excursion" in the autumn of 1789, en route from Cuernavaca to Acapulco, and again on the return. It is a little more than 10 km S of Chilpancingo on the seaward slope of the mountains. In PNH spelled variously, e.g. "in Mazallami, praedio itinere Acapulcensi." In FM (ed. 2) usually "in montibus Mazatlani," not "Mazatlami." In the S. & M. herbarium 2 specimens, *Asclepias* sp. and *Smilax* sp., bear the epithet *mazatlanensis.*

Mazatlán, [Sin.] 23°13′ N., 106°25′ W.*

This is one of the localities recorded in Sessé's notebook of 1791; see text, p. 133. Reference is made to "ad litora Portus Mazatani," or to "Mazatan."

Mectepec: see Metepec.

Medellín

Not located; presumably in Oaxaca, Chiapas, or Central America. In FGU the reference is to "montibus Medellin."

Meitepec: see Metepec.

Mestitlan: see Metztitlán.

Metepec

Not located. Sprague (1926, p. 424) supposed it to be in Hidalgo or the State of México. There are at least four places near the City of México by this name (1 in Hidalgo, one in México, 2 in Puebla) that might have been visited by the expedition. The name is cited in PNH. Also cited in PNH are Mectepec, Meitepec, Mictepec (ed. 1), and Mitepec; Metepeque is cited in FM. I suppose all these pertain to the same place. Almost invariably the locality is said to be "in calidis [or calidioribus, or calidissimis] montibus." This would seem to rule out the Metepec near Toluca (Edo. de México), but perhaps the others may be said to be in "hot mountains."

Metztitlán, [Hgo.] 20°36′ N., 98°45′ W.*

About 50 km N of Pachuca. Sessé, with Castillo, worked here Aug–Sep 1792; see Hidalgo. Citations in FM are "in pratis Mestitlani," "in clivo S. Monicae

jurisdictionis Metztitlani," "in anfractibus Mextitlani," "inter rupes aridorum montium Meztitlani." See Santa Mónica, and San Juan de Amajaque.

Mexicaltzingo, [D.F.]

Now well within the urban area, about 8 km SE of the center of Mexico City. Apparently the "First Excursion" passed through here in November 1788, on the return from Ayacapixtla. See text, p. 126.

Mexicanorum Carmelitarum Eremo: see Desierto de los Leones.

Citation: "in frigidissimis montibus Mexicanorum Carmelitarum Eremi."

México, [D.F.] 19°24′ N., 99°09′ W.*

In the S. & M. herbarium are about 20 specimens variously labelled as from localities in the valley of Mexico, including "in montibus Mexico vicinis," "Mexici," "in Mexico," "in Mex. circuitibus," "in hort. Regio Mexicano" (or merely "Hort. M."), San Angel (or "in montibus S. Angeli"), San Agustin (or "in montibus S. August."), or "in Heremo P.P. Carmelitarum." The epithet *angelicum* presumably refers to San Angel. In PNH and FM there are very many references to México itself, to the above places, and to other nearby places; cf. Chapultepec, Coyoacán, Ixtacalco, Ixtapalapa, the "lacu Mexicano," Mexicaltzingo, Peñol, San Nicolás, Santa María de los Remedios, Tacubaya, Tepelpa, Texcoco, Tlalnepantla. It is impossible to establish dates for visits made to these places; the expedition was based in México from 1787 to 1803; see text, p. 124.

Mextitlan: see Metztitlán.

Mezquite, [Sin.]

Mentioned in Sessé's notebook of 1791 and presumably visited by the botanists of the "Third Excursion"; see text, p. 133. The reference in FM is "in Predio *Mezquite* dicto prope Sinaloan." The place is shown on the García y Cubas map of 1863, about 10 km SE of Sinaloa, q.v.

Meztitlan: see Metztitlán.

Michaelopolis, [Gto.]: see San Miguel de Allende, and Atotonilco.

Michaelopolis, [Salvador]

Same as San Miguel; see Salvador. The Latin form is used in FGU, as in "montibus Chinamecae prope Michaelopolin"; this is one of at least 18 references to this place.

Michoacán, Estado

The "Third Excursion" came from Guanajuato, q.v., to Morelia, then went on via Pátzcuaro, Uruapan, and Apatzingán, to Coahuayana, in the summer and autumn of 1790; see the above places, or text, p. 130. Sessé and Castillo came from Toluca and Temascaltepec in 1792 to Zitácuaro, q.v., and nearby places; they returned to México the same summer; see text, p. 138. In the S. & M. herbarium the epithet *michoacana* is applied to *Operculina rhodocalyx*.

Mictepec, Mitepec: see Metepec.

"Mitequense flumen"

Not located; the name is mentioned in PNH (ed. 2, p. 4). Presumably in Mexico.

Mixteca, La: see Oaxaca.

Monterey, [Calif.] 36°36′ N., 121°53′ W.*

See Nootka, or text, p. 137. Mociño travelled to Nootka from San Blas in 1792 with Juan Francisco Bodega y Quadra, commanding the *Santa Gertrudis*. On the return

trip Bodega was in Monterey from 9 Oct 1792 to 13 Jan 1793. Mociño left Nootka on 21 Sep 1792, and arrived in San Blas 2 Feb 1793, so it may be assumed that he was in Monterey with Bodega y Quadra. In the S. & M. herbarium a few specimens, identified as *Perezia dugesii, Eschscholtzia californica,* and *Prunus emarginata,* bear the epithets *californica* (*-um*) or *californianus.*

Morelia, [Mich.] 19°42′ N., 101°07′ W.*

In the time of Sessé & Mociño known as Valladolid (Lat. Vallisoletum). The botanists and artists of the "Third Excursion" arrived here early in August 1790 and proceeded after a few weeks to Pátzcuaro; see text, p. 131, and see Guanajuato. Sprague (1926, p. 424) gave the location of this place as in the State of Querétaro. References in PNH include "prope Vallisoletum in thermis Cuinchi."

Morro, Castillo del, [Cuba]. 23°09′ N., 82°21′ W.*

See Havana; the reference in FM is "Habana, ad litora maris juxta Castellum del Morro." The fort is situated at the entrance to Havana harbor, on a point north of the city.

Morro, Castillo del, [P.R.] 18°28′ N., 66°07′ W.*

See Puerto Rico, [P.R.]. The fort is situated at the entrance to the harbor, on the point west of the old city.

Moscoso, [Praedium de, Guatemala]

Not located; referred to in FGU as being in the Sierra de Cuchumatanes. See Guatemala.

Motagua, Río, [Guatemala]

Mentioned in FGU, with the spelling "Montagua," and the implication it was near Guatemala City. The Río Motagua is a large river that runs from W to E across the country, at no great distance N of Guatemala City; see Guatemala.

Nagarote, [Nicaragua] 12°16′ N., 86°34′ W.*

About halfway between León and Managua; see Nicaragua, and Mateare. Mociño presumably passed through here twice in 1797.

Nandio, [Mich.]

Absent from most maps, but shown on the Hinton map of 1939 (scale 1/250,000, publ. by J. Hinton & J. Rzedowski in J. Arnold Arb. 53, with pp. 141–170. 1972, and in An. Esc. Nac. Ci. Biol. [Méx.] 21, with pp. 1–114, publ. Apr 1976). The references in FM are "in oppido *Nandio* et in Praedio de los Laureles," and "in oppido Nandio, prope Zitacuarum." Nandio appears to be about 6 km SSW of Zitácuaro, q.v.; what is probably the same place appears as Enandio on the García y Cubas map of 1863.

Naranjal, [P.R.]

Not located, but presumably near Manatí, q.v.

Nejapa, [Salvador] 13°49′ N., 89°14′ W.*

About 15 km NNW of San Salvador; spelled Nexapa in FGU. See Salvador.

Nejapan, [Oax.] 17°35′ N., 98°22′ W.*

About 20 km ENE of Tlapa, Gro., and 90 km E of Chilapa. The references in PNH include "in umbrosis praedii de *Nexapa* montibus prope iter Acapulcense." See Tlapa; several references in PNH to places near Tlapa suggest that the "Second Excursion" returned to México from Acapulco by this route, late in 1789; see text, p. 186.

Nexapa: see Nejapan.

Nicaragua

Mociño was in Nicaraguan territory from Apr or May 1797 until about the end of the year. On the outward trip he seems to have crossed the Gulf of Fonseca from a locality in Salvador. q.v., to the port of Realejo, whence he passed to León, presumably by way of the mountains of El Viejo, and Chinandega. From León he seems to have passed by way of Nagarote, Mateare, Managua, and Masaya, to Granada, whence he undertook an excursion, via Brito and ?Escalante, into Costa Rica, q.v. On the return trip to Mexico he was in León on 2 Dec 1797 and in San Salvador on 12 Feb 1798. In FGU about 35 species are listed from León; 2 of these are published in FM. About 50 additional species from unspecified localities in Nicaragua are listed in manuscript; a few appear in FM. In the S. & M. herbarium the epithet *nicaraguense* is applied to a species of *Melothria*.

Nicaragua, [Nicaragua]

One reference in FGU is to a place (La Cabeza) between Granada and "Nicarabuam." This presumably meant the City of Nicaragua, now called Rivas (11°26′ N., 85°51′ W.*). See Nicaragua, or La Cabeza.

Nicoya, [Costa Rica] 10°09′ N., 85°27′ W.*

See Costa Rica, or text, p. 148.

Nochiztlan: see Xochitlán.

Nootka [Island, British Columbia]

See text, p. 136. Mociño spent the summer of 1792 at the Spanish base near the south end of the island, ca. 49°37′ N., 126°35′ W.* He returned to San Blas, Nay., about the first of February, 1793, probably having passed 3 months (mid-Oct to mid-Jan) in Monterey, Calif. While the expedition was based on Nootka Island, the anatomist Maldonado accompanied a ship commanded by Jacinto Caamaño, about 800 km further northwest into what is now southern Alaska; see Bucareli. Nootka is the accepted modern spelling; Mociño usually preferred "Nutka." Spanish activities on the northwest coast during this period are well documented (Cook, 1973).

Nutka: see Nootka.

In the S. & M. herbarium *Lonicera involucrata* and *Cornus pubescens* bear the epithet *nutkensis*. *Symphoricarpos albus, Artemisia douglasiana* and *Sanguisorba sitchensis* are labelled "Nutka" or "de Nootka." *Fritillaria camschatcensis* bears the epithet *Kamskatense*.

Oaxaca, Estado

See Oaxaca, [Oax.], Petapa, Tehuacán, Huayapa, Nejapan, Tepetlapa. In the S. & M. herbarium a specimen of *Piper auritum* is labelled "el Obispado de Oaxaca."

Oaxaca, [Oax.] 17°03′ N., 96°43′ W.*

Mociño was in Oaxaca 23–24 May, 1793; from here he returned to Córdoba, Ver., q.v., perhaps after mid-July. Archival references to his exploration of the "Misteca" are vague. Probably he spent very little time in Oaxaca during this season; see text, p. 140. Mociño, with the artist Cerda, was in or near this place at least in Nov–Dec 1795 and again, on the return from Guatemala, in Dec 1798 (Cerda) or Jan 1799 (Mociño); see text, p. 149. The route outward was via Tehuacán to Oaxaca, then to Ocotepec, Zoquitlán and Tehuantepec.

Obraje, El, [Nicaragua]

See Nicaragua. The reference in FGU is "Nicaraguae Vico vulgo dicto el Obrage inter Theobromae." The name is not found on most general maps. El Obraje was described by Squier (Nicaragua 2: 81. 1852) as about a league [north] from Rivas, q.v., "one of half a dozen towns, situated within a radius of two leagues around . . .

Rivas . . . and which are, to all intents and purposes, parts of it." Squier mentions the cocoa plantations that were still numerous near Rivas, a half-century after Mociño's visit.

Oceani Asiatici litoribus, [or Oceani Australis littoribus]

The shores of the Pacific Ocean, presumably near Coahuayana, Mich., q.v.

Ocoapán, [Tab.] ca. 17°50′ N., 93°27′ W.

Between Mecatepec and Huimanguillo. The citation in FM is "habitat in Ocoapam." *Solanum ocoapense,* with type-locality Ahualulco (q.v.) was published in FM; the presumption is that Ocoapán is near Ahualulco. Mociño probably passed through here in 1794. See text, p. 142.

Ocotepec, [Oax.] 16°48′ N., 96°24′ W.*

About 45 km SE of Oaxaca, q.v. The reference in FM is "Nascitur Ocotepec." There are several places in Mexico by this name, including one near Cuernavaca, that could have been visited by Sessé or Mociño. The place above seems most likely because it is on one of the main roads from Oaxaca to Tehuantepec, and Mociño presumably passed through it in 1795. It is mentioned in FM but not in PNH.

Ocozocoautla, [Chis.] 16°46′ N., 93°22′ W.*

See Chiapas, Estado; in FGU there is one reference to "Ocozocoautlae oppido." This place is about 30 km W of Tuxtla Gutíerrez, on the road from Tehuantepec.

Ojo de Agua, Praedium, [Ver.]

Not located; presumably an hacienda near Córdoba, q.v.

Orizaba, [Ver.] 18°51′ N., 97°06′ W.*

Sessé, with the artist Echeverría, worked in the region of Córdoba and Orizaba from about June to October, 1793; see Córdoba. There are numerous references in FM to Orizaba (usually spelled "Orizava"), and two to the Volcán ["vulcanum"] de Orizaba. See San Andrés, Tospa, San José de la Laguna, Volcán de Orizaba. In the S. & M. herbarium about 8 specimens are labelled as from "Orizava," or with the epithet "orizavicum"; one sheet, *Rubus* sp., is marked "in vulcano Orizav."

Ostimuri, [Son.-Sin.]

Not a locality, but a name applied to the coastal lowlands W and SW of Alamos, q.v. On the Disturnell map of 1847 (Mapa de los Estados Unidos de Méjico, ca 70 mi. = 1 inch), "Ostimury" occupies the coastal region between the Río Mayo and the Río Fuerte, i.e. mostly in Sonora. Visited by the botanists of the "Third Excursion," probably in Oct 1791; see text. p. 133. Sessé refers to "maritimis Provinc. Oszimuri [or Ostimuri]."

Palo Seco: see Cangrejos.

Papantla, [Ver.] 20°27′ N., 97°19′ W.*

In FM there are 2 references to this place; see Veracruz, Estado. It is presumed that Sessé and Castillo turned back toward México from here, about Oct 1792.

Paramita, [Nay.] 22°09′ N., 105°11′ W.*

Ca 40–50 km SSE of Acaponeta. Visited by the botanists of the "Third Excursion" in the autumn of 1791, and recorded in Sessé's notebook of the same year; see text, p. 133. The reference in FM is "in calidis Praesidii Paramitae agris." In the S. & M. herbarium a specimen of *Sida acuta* bears the epithet *paramitae.*

Parangueo, [Gto.] 20°24′ N., 101°18′ W.*

About 12 km W of Valle de Santiago, and 20 km SW of Salamanca. The "Third Excursion" passed through here en route from Guanajuato, q.v., to Morelia, probably

in late July, 1790. The name is cited several times in PNH and FM, but almost always misspelled, e.g. "in haereditate Puranyuco prope Salmanticam," "in praedio Paranques prope Salmantinam," "in praedio Paranquera prope Salmantinam." The name is absent from most modern maps; cf. ATLAS sheet "Guanajuato" (ed. 1943).

Paranquera, Paranques: see Parangueo.

Pátzcuaro, [Mich.] 19°31′ N., 101°36′ W.*

About 50 km SW of Morelia. The botanists and artists of the "Third Excursion" reached this place early in September, 1790, and probably spent about two weeks in the vicinity; see text, p. 131. They went on to Uruapan, via Tingambato, before the first of October. About 20 species from the vicinity of Pátzcuaro are described in PNH, and in the S. & M. herbarium 3 plants bear the epithet *patzcuarensis.*

Peñol, [thermas del], [D.F.]

The reference in PNH is "in aquaeductibus Mexicanis, praesertim prope thermas del Peñol vulgo dictas." Presumably these are the baths described by Fanny Calderón de la Barca (1966, pp. 334–335), at the base of the Cerro del Peñón, which was once an island in Lake Texcoco. The place is now well within the urban area of Mexico City, about 15 km SE of the center. Peñol Viejo and Peñol Grande are shown in this same area on Carta Rep. Mex. 1/100,000, hoja 19-I-M.

Perote, [Ver.] 19°34′ N., 97°14′ W.*

Not mentioned in PNH or FM, but see text, p. 139. Sessé passed this place in July 1793.

Petapa, [Oax.] 16°50′ N., 95°07′ W.*

In FGU there is one reference, "prope Petapae oppidum in Tehuantepecensi provincia montibus." See Oaxaca, [Oax.]. Petapa is about 50 km N of Tehuantepec, in the hills north of the wide coastal plain.

Piaxtla, [Sin.] 23°52′ N., 106°39′ W.*

This is about 75 km NNW of Mazatlán, near where the route of the "Third Excursion" crossed the Río Piaxtla in the autumn of 1791; the locality is mentioned in Sessé's notebook of 1791; see text, p. 133.

Planta N., Praedium

Not precisely located; evidently an hacienda near the City of Puerto Rico (San Juan), q.v.

Ponce, [P.R.] 18°01′ N., 66°37′ W.*

Visited by Sessé in the early summer of 1796; see text, p. 144. References in FM include "in montibus de Ponce," "in agris de Ponze," "ad litora maris Portum de Ponze abluenti."

Pozo del Agua Grande, Praedium, [Ver.]

Not located; presumably an hacienda near Córdoba, q.v.

PP. Carmelitarum montibus: see Desierto de los Leones.

Puebla, Estado

Sessé and Castillo crossed through this State in August or September 1792; see Veracruz, Estado. See also Puebla, [Pue.].

Puebla, [Pue.] 19°03′ N., 98°12′ W.*

Cited in FM under the name of Angelopolis (from Puebla de los Angeles; cf. Sprague 1926, p. 423). Puebla then, as now, lay on the main route to Orizaba, Veracruz, Jalapa, Tehuacán, and Oaxaca, and was visited on various occasions by Sessé

(1792, 1793, 1794) and Mociño (1795). Oddly enough there seem to be only 3 direct references to "Angelopolis" in FM. In the S. & M. herbarium 2 specimens, perhaps collected by Antonio Cal or Ignacio León, are labelled as from "Puebla." Sessé was in Puebla 18 Dec 1792, 15 Jun 1793, and for a time in November and thereafter, 1794. Mociño apparently worked for 4 months in the region of Puebla and Tehuacán, Jul–Oct 1795. See text, pp. 139 and 146.

Pueblo Viejo, [P.R.]

Not certainly located; a U.S. Military Map of 1898 shows a place of this name ca 4 km S of San Juan. The reference in FM is "ad litora maris juxta Oppido de Pueblo Viejo." See Puerto Rico, and text, p. 144.

Puerto Rico

Sessé, with the artist Echeverría, worked on the island from Apr 1796 until May 1797. They travelled and collected continuously at least until Aug or Sep 1796. Apparently they began to collect near the city of Puerto Rico (now San Juan), crossed the island from Toa Alta to Ponce, then continued to the west end of the island and on around the shore to the north side and came again to San Juan. A second trip, probably from July to September, 1796, seems to have taken them from San Juan to the east end of the island. See text, p. 144. About 20 specimens in the S. & M. herbarium are labelled "Puerto Rico." Most references to this name in FM are presumably to the city of Puerto Rico, q.v.

Puerto Rico, [P.R.] 18°28′ N., 66°06′ W.*

Sessé, with the artist Echeverría, seems to have worked in and out of this city, the modern San Juan, then called San Juan de Puerto Rico, or merely Puerto Rico, during the summer of 1796. In FM there are references to various nearby localities, e.g. Castellum del Morro, Cangrejos, Ingenio Viejo, Río Piedras, Palo Seco, Loiza. See Puerto Rico, or text, p. 144. In FM references to the city itself include "intra civitatem de Puerto Rico florentem vidimus," "prope Castellum del Morro, urbis de Puerto Rico," and "ad litora maris in Predio del Planta N., haud procul ab urbe de Puerto Rico."

Punta, La (or Praedium de la).

Not certainly located. Sprague (1926, p. 424) suggested that it might be in Veracruz. Possibly it was the same as the place called San Juan de la Punta, which according to Alvarez & Duran (1856) was 3 leagues ESE of Córdoba, q.v. (but see also San Lorenzo). In FM there are at least 16 references to La Punta, mostly to species flowering in August. Some of the references are to a settlement, e.g. "in oppido de la Punta," others to the hacienda of the same name, e.g. "in Praedio de la Punta" or "in Puntae hereditate." One reference clearly refers to both: "inter oppidum de la *Punta* et Praedium ita dictum." There is a place called La Punta in SW Chiapas, east of Tehuantepec, that Mociño could have visited on his way to Guatemala in 1795, but this is unlikely because the place is not mentioned in the manuscript Flora of Guatemala. In the S. & M. herbarium *Calliandra papillosa* and *Melasma hispidum* are labelled as from La Punta.

Puranyuco: see Parangueo.

Puruándiro, [Mich.] 20°05′ N., 101°30′ W.*

About 65 km SW of Salamanca, Gto. The "Third Excursion" passed through here, probably in late July 1790, en route from Guanajuato, q.v., to Morelia. In PNH the citations are "in Puruandiri montibus," and "prope Puruandirum."

Quahuayanae: see Coahuayana.

Quanabacoa: see Guanabacoa.

Quaunahuaca, Quahunahuaca, etc.: see Cuernavaca.

Quaxiniquilapa, [Gro.]

Not found on any map. This was a station on the mountain road between Chilpancingo and Acapulco. According to Alvarez & Duran (1856), the *Rincon de Quaxiniquilapa* was 5 leagues below Acahuizotla, q.v. The "Second Excursion" passed through here in the autumn of 1789, en route to Acapulco and on the return to Cuernavaca. References in PNH are "in Cuaximipilapae montibus," and "ad torrentes fluminis Quaxinipilapae in itinere Acapulcum versus ducente." Wilson (p. 134) notes that Pineda passed through here, between Dos Caminos and Acahuizotla, in May 1791.

Querétaro, [Qro.] 20°36′ N., 100°23′ W.*

The "Third Excursion" passed some days here in May or early June 1790; see text, p. 130. There are numerous references to the place in PNH, and the epithet *queretarensis* is applied to a species of *Ipomoea* in the S. & M. herbarium. From Querétaro the expedition passed on via Ixtla, San Miguel, Atotonilco, San Damián, and Santa Rosa, to Guanajuato.

Quezaltenango, [Guatemala] 14°50′ N., 91°31′ W.*

See Guatemala. In FGU there are about 5 references to this place.

Quyaucan, Quyuacan: see Coyoacán.

Rancho Grande, [Chis.]: not located; see Comitán.

Realejo, [Nicaragua] 12°32′ N., 87°10′ W.*

See Nicaragua, and Chinandega. In FGU there are about 4 references to "Realexo montibus, maritimis." Realejo was an important port until well into the 19th Century, but has almost passed from modern maps. It was almost S of Chinandega.

Regla, [Cuba]: see Regla, [Hgo.]

Regla, [Hgo.] 20°15′ N., 98°34′ W.*

The reference in FM is "Habitat oppido de Regla. Vulgo *Guisaro*. Floret Februario." The species described from this locality is *Achyranthes glomerata* Sessé & Moc., which as far as I can determine has not been identified. I cannot find that the name *guisaro* is commonly applied to any plant, whether Mexican or Cuban. The Cuban Regla in Sessé's time was on Havana harbor between the central city of Havana and Guanabacoa; see Havana. Sessé could have collected the plant there in February, 1796 or 1798. The Mexican Regla is about 20–25 km NE of Pachuca. Sessé and Castillo may have passed through in the summer of 1792, on the road from Atotonilco to Tulancingo; see Hidalgo, Estado.

Remedios: see Santa María.

Rincón, [P.R.] 18°20′ N., 67°15′ W.*

See Aguadilla, and text, p. 144.

Río Piedras, [P.R.] 18°24′ N., 66°03′ W.*

Sessé visited this place, probably in Sep 1796; see text, p. 144. The reference in FM is "in montibus de Rio Piedras ad Praedium de la *Campana* interjectis."

Rivas, [Nicaragua]: see Nicaragua, [Nicaragua], or Cabeza.

Rosario, [Sin.] 23° N., 105°52′ W.*

Visited in 1791–92 by the botanists and artists of the "Third Excursion"; see text, p. 133. Rosario lies on the lowland road between Tepic and Sonora, some 60 km SE of Mazatlán.

Saibanito, Saibonito, [P.R.]: see Aibonito.

Salamanca, [Gto.] 20°34′ N., 101°12′ W.*

Botanists and artists of the "Third Excursion" passed through here, probably in late July 1790. See Guanajuato, and text, p. 130. Cited indirectly in PNH, as Salmantina or Salmantica; see Parangueo, or Temascatío.

Salmantica (Salmantina): see Salamanca.

Salud, La, [Cuba] 22°52′ N., 82°25′ W.*

See Havana. The reference in FM is "in hortis suburbi de *La Salud* Habanae"; also "in agris suburbii de la Salud, prope Puellarum Hospidium."

Salvador, El

Mociño was in the territory of El Salvador from about Feb 1797 to April of the same year, and for a time, on his return from Nicaragua, q.v., from about Jan to Mar, 1798. From the last outposts in Guatemala, q.v., he seems to have passed Ahuachapán, Santa Ana Grande, and Nejapa, before reaching San Salvador (before 4 Mar 1797). He probably visited Sonzacate and Sonsonate, then continued via Cojutepec, Apastepec, San Vicente, Tepetitán, Zacatecoluca, Chinameca and San Miguel. As far as known, Mociño's return trip in 1798 was by the same route; he was in San Salvador on 12 Feb. The Latin equivalent used in FGU is "Sancti Salvatoris [or Servatoris] Provinciae."

San Agustín, [D.F.]

See México. In the 18th Century this was a small village, San Agustín de las Cuevas, less than 4 leagues [17–18 km] southwest of the city on the edge of the mountains. The "First Excursion" probably was based here in September 1788. Now called Tlalpan (or Tlalpam), it is near the edge of the congested urban area. References in PNH are to "frigidis Sancti Agustini montibus Mexico vicinis."

San Andrés del Valle: see Valle de Bravo.

San Andrés, [Ver.]

See Orizaba. Not located on a map. Presumably in the foothills where Sessé might have approached the peak of Orizaba along the road between Orizaba and Puebla. The reference in FM is, "supra arbores montium frigidorum S. Andreae juxta vulcanum de Orizava."

San Andrés Tuxtla, [Ver.] 18°27′ N., 95°13′ W.*

Cited in FM as "in oppido Sancti Andreae de Tuxtlae." Mociño spent some weeks here in the autumn of 1793, and made two ascents of the erupting volcano of San Martín Tuxtla. See text, p. 141. and Mociño's account in Noticias de Nutka (Carreño, 1913, pp. 103–117). In FM about 59 species are reported from Tuxtla, about half of them said to flower Jun–Jul, the rest Aug–Dec.

San Angel, [D.F.]

See México. In the 18th Century San Angel was a village 2 leagues from México. It is now a part of the city, about 10 km south of the center. In PNH and FM it is often referred to as "San Angel prope Mexicum." The "First Excursion" apparently was based here from June to August, 1788.

San Antonio, [Méx.] 19°40′ N., 99°46′ W.

See Ixtlahuaca, or San Felipe del Obrage.

San Antonio, Puerto de, [Alaska]

See text, p. 136, and see Bucareli, Puerto de.

San Antonio de Tepango, [Pue.] 20° N., 97°49′ W.*

About 20 km ENE of Zacatlán de las Manzanas. Sessé and Castillo passed this place, Aug–Oct 1792; see Veracruz, Estado. In FM the reference is to "montibus inter oppida Sancti Antonii de Tepango et Sancti Bernardini. Floret Oct." In the S. & M. herbarium *Salvia candicans* is labelled [perhaps by Ignacio León], "Cogida en Tepango."

San Bartolomé, [Chis.] 16°21′ N., 92°33′ W.*

See Chiapas, Estado; in FGU there is a reference to "in Sancti Bartholomaei Chiapensis Provinciae montibus," and one to "montibus Teopiscam, atque Sancti Bartholomaei oppidum separantibus." San Bartolomé is now called Venustiano Carranza.

San Bartolomé, [Qro.]

The reference in PNH (ed. 2, p. 67) is "ad thermas Sancti Bartolomaei prope Queretarum." See Querétaro. The baths, or hot springs, of San Bartolo, are very near Querétaro, west or slightly south of west of the city, on the old road to Celaya.

San Bernardino, [Pue.] 20°02′ N., 97°47′ W.

About 25 km ENE of Zacatlán de las Manzanas. Sessé and Castillo passed this place, Aug–Oct 1792; see Veracruz, Estado, and San Antonio de Tepango.

San Bernardo, [Pue.]: see Xochiatlán.

San Blas, [Nay.] 21°31′ N., 105°16′ W.*

See text, pp. 134, 136. Apparently there is no reference in FM to this port.

San Cristóbal de las Casas, [Chis.] 16°45′ N., 92°38′ W.*

Known in 1795 1798 as Ciudad Real ("Civitas Regia"). See Chiapas, Estado, and text, p. 147. In FGU there are at least 55 references to plants from "Civitatis Regiae montibus, agris," etc., and one to "montibus Civitatem Regiam, Chiapamque separantibus." In FM the reference (*Cytisus nigricans*) is "in Comitani ac Civitatis Regiae circuitibus."

Sancti: see San, of which this is a latinized form.

Sancti Eremi (or Heremi): see Desierto de los Leones.

Sancti Hieronymi (or Hyeronymi) montibus: see San Gerónimo.

S[ancti] Jacobi: see Temascaltepec.

Sancti Oppido

This appears in PNH ed. 1, p. 136; in ed. 2, p. 127, it is written "Sancti . . . Oppido," indicating the omission of the name of the saint for whom the town was named.

Sancti Salvatoris (or Servatoris) Provincia: same as El Salvador; see Salvador.

S[ancti] Thomae, or Tomae: see Hostotipaquillo.

San Damián, [Gto.] 20°58′ N., 101° W.*

This is about 25 km, airline, E of Guanajuato. The "Third Excursion" passed through probably in late June, 1790, en route from Querétaro, q.v. The citation in PNH is "in Sancti Damiani agris prope iter montanum a Michaelopoli Guanaxuatum versus ducens."

San Felipe del Obrage, [Méx.] 19°43′ N., 99°57′ W.*

Sessé and Castillo presumably passed through here in the summer of 1792; see text, p. 138. Citations in FM are "in montibus ex oppido Sancti Antoni ad Sanctum

Philipum del Obraje interpositis," "agris Sancti Filipe del Obrage," "intra oppidum *Sancti Filipi del Obrage* in valle Tolucense."

San Francisco, [Méx.]

Not definitely located; see Temascaltepec. The reference in FM is "in Oppido Sancti Francisci, justa Fodinas Temascaltepec." There is a place called San Francisco, ca. 7–8 km E of N of Valle de Bravo, thus little more than 25 km from Temascaltepec. Perhaps this is the place mentioned in FM.

San Germán, [P.R.] 18°05′ N., 67°03′ W.*

Sessé visited here, probably in May or June 1796; see text, p. 144. The reference in FM is "in Oppido de San German."

San Gerónimo, [Gro.]

Not precisely located; evidently visited during the "Second Excursion" in 1789; see text, p. 128. The reference in PNH is "in Oppidi Sancti Hieronymi prope Chilapam montibus." An alternative spelling is "Hyeronymi."

San José de la Laguna: see Tospa.

San Juan, [P.R.] 18°28′ N., 66°06′ W.*

See Puerto Rico, and text, p. 144. This was called San Juan de Puerto Rico, or in the time of Sessé's visit in 1796, simply Puerto Rico.

San Juan de Amajaque [Amajac], [Hgo.] 20°43′ N., 98°57′ W.*

Sessé and Castillo worked here in ?August, 1792; see Cardonal, and Hidalgo. In FM references are as follows: "in clivo de la Libreria ad S. Juan de Amajaque," and "in descensu profundissimis anfractibus S. Joanis de Amaxaque juxta Meztitlan."

San Juan de la Punta, [Cuba]

Not precisely located; evidently near Havana, q.v.

San Juan de los Lagos, [Jal.] 21°15′ N., 102°18′ W.*

There are no references to this place in PNH; in FM there is one only, viz., "in montibus Sancti Joannis de los Lagos. Floret Februario." Longinos Martínez presumably passed through here in February 1791; see text, p. 134. It is possible that Mociño came through a year later, on his way from Aguascalientes to Tepic, or on his return to México in the same month, in 1793.

San Juan de los Plátanos, [Mich.] 19°08′ N., 102°27′ W.*

The "Third Excursion" passed through this place, about 12–13 km W of Apatzingán, q.v., in Dec 1790, en route to Coahuayana. The citation in PNH is "in . . . Sancti Joannis vulgo *de los Plátanos* oppido prope Apatzingam."

San Juan del Río, [Qro.] 20°23′ N., 100° W.

The "Third Excursion" passed through here, about 50 km SE of Querétaro, on the regular road to Guanajuato, in May 1790. There are references to the place in PNH, e.g. "ad margines fluvii Villae Sancti Joannis vulgo del Rio."

San Lorenzo, [Ver.] 18°50′ N., 96°48′ W.*

The reference in FM is "in Oppido S. Laurentii, juxta Cordovam." According to Alvarez & Duran (1856), the pueblo of San Lorenzo Cerralvo was 3 leagues ESE of Córdoba, q.v. The actual distance is at least 15 km.

San Martín, [Guatemala] 15°34′ N., 91°40′ W.*

Mentioned in FGU; see Guatemala. This is apparently San Martín Cuchumatanes, ca 25 km SE of Santa Ana Huista.

San Martín de Texmelucan, [Pue.] 19°17′ N., 98°26′ W.*

About 25 km W of Tlaxcala, and 35 km SSE of Calpulalpan, q.v. References in FM are "in aridis agris S. Martini de Tesmelucan," and "in pratis arenosis Calpulalpam et San Martin de Tesmelucam interpositis."

San Mateo, [Mich.] 19°29′ N., 100°15′ W.*

Sessé and Castillo visited here, probably in August 1792; see Zitácuaro. The reference in FM is "in montibus S. Matei prope Zitacuarum." The place is about 15 km NE of Zitácuaro.

San Miguel, [Salvador] 13°29′ N., 88°11′ W.*

See Salvador. In FGU this place was called Michaelopolis.

San Miguel de Allende, [Gto.] 20°55′ N., 100°45′ W.*

The "Third Excursion" passed through here in June 1790, en route from Querétaro, q.v., to Guanajuato. In PNH the place is cited as Michaelopolis (see Sprague 1926, p. 423). A reference in PNH is "in montibus Michaelopolitanis."

San Nicolás, [D.F.]

Not certainly located; not mentioned in PNH, but in FM cited several times in terms of high cold mountains, e.g. "in frigidis Predii S. Nicolai montibus." Another reference is "ad margines aqueductum Predii Sancti Nicolae." Most likely seems San Nicolás Totolapa, which is near Contreras, D.F., and, according to Alvarez & Duran (1856), was somewhat more than 2 leagues SSW of San Angel. See México, and San Angel.

San Salvador, [Salvador] 13°42′ N., 89°12′ W.*

This place was called Servatoropolis in FGU. See Salvador. Mociño was in the capital city at least by 4 Mar 1797 on his trip to Central America, and may have departed for Nicaragua by 1 May. On the return trip in 1798 he was in León on 2 Dec 1797, in San Salvador on 12 Feb 1798, and in Guatemala City on 9 May.

Santa Ana Amatlán, [Mich.] 19°09′ N., 102°33′ W.*

About 20 km W of Apatzingán, q.v.; the "Third Excursion" passed through here in Dec 1790, en route to Coahuayana. The reference in PNH is "In calidissimis Sanctae Annae Amatlam agris, Apatzingam inter ac Tepalcatepec." The name appears as Amatlán on many modern maps.

Santa Ana [Grande,] [Salvador] 13°59′ N., 89°34′ W.*

See Salvador; in FGU the reference is "in Sancti Servatoris Provincia Santa Ana Grande."

Santa Ana Huista, [Guatemala] 15°41′ N., 91°49′ W.*

See Guatemala. This was one of the first places Mociño passed after crossing the border between Chiapas and Guatemala. A reference in FGU is "montibus ab Escuintenango in Huistae Oppidum interiectis." Other references are to "Guistlae sylvis," and "in oppido Sanctae Annae Guistae." Sometimes spelled Huistla.

Santa Fe, [D.F.]

Now well within the urban area, ca 10 km WSW of the center of Mexico City. The reference in FM is "in collibus de Sancta Fe haud procul a Mexico."

Santa Iphigenia

Not located; presumably in Mexico. The reference, in PNH, ed. 2, p. 13, is "ad torrentes fluminis praedium Sanctae Iphigeniae irrigantis." The usual modern spelling of this name is Efigenia. There are several places in Mexico called Santa Efigenia, but none I have found that fits into the known pattern of the Botanical Expedition.

Santa María [Nuestra Señora] de los Remedios, [D.F.]

Now well within the urban district, in the hills 12–13 km WNW of the center of Mexico City. It was visited by the botanists before May, 1788 (see text, p. 125). Published citations are to "aridis Sanctae Mariae Remediorum [or Sanctae Mariae de los Remedios] prope Mexicum montibus."

Santa María de Tetela, [Mor.] 18°55′ N., 99°15′ W.

Not located on a map; the reference in PNH is "ad torrentes fluminis Sanctae Mariae de Tetela prope Quauhnahuacam." I take this to be the place called Santa María, which according to Alvarez & Duran (1856) was 2 leagues NNW of Cuernavaca. On the Carta General del Estado de Morelos, 1/100,000 (1910), Santa María is shown about 5.5 km NNW of Cuernavaca, and Tetela about 4.5 km from the city, in the same general direction.

Santa Mónica, [Hgo.] 20°28′ N., 98°42′ W.*

Sessé and Castillo passed through here in August or September 1792; see Hidalgo. From the citation in FM it seems they were en route to or from Metztitlán: "in clivo S. Monicae inter oppida de Atotonilco el *Grande* et *Meztitlan.*"

Santa Rosa, [Coah.] 28°41′ N., 100°30′ W.*

Ignacio León (cf. p. 110) wrote Sessé several letters in 1792–1793, from a place called Valle de Santa Rosa, or Praedio de Santa Rosa (MA, 4ª Div., núm. 14). He described a number of plants from the locality, and sent seeds and specimens to Sessé. A few plants in the Sessé & Mociño herbarium, attributed to León, are characteristic species of the Texano-Mexican frontier, e.g. *Ehretia anacua,* and *Jatropha cathartica.* I presume, therefore, that the Santa Rosa of León was the place now called Múzquiz, originally called Santa Rosa, and then until well into the 19th Century, Santa Rosa de Múzquiz.

Santa Rosa, [Gto.] 21°04′ N., 101°12′ W.*

The "Third Excursion" passed some days here, in the mountains about 10 km NE of Guanajuato, probably in late June, or July, 1790. In PNH there are many references, e.g. to the mountains near Santa Rosa, or "in Sanctae Rosae oppido prope Guanajuatum." A variant spelling is "S[anctae] Rossae."

Santiago de la Vega, [Jamaica]

References in PNH are to Linnaean localities, as under *Boerhaavia scandens*: "Habitat in Jamaica, in oppido Apatzingan et in civitate S. Jacobi de la Vega."

Santiago Ixcuintla, [Nay.] 21°49′ N., 105°13′ W.*

About 50 km NW of Tepic, on the lowland road to Sinaloa; see text, p. 133. This is one of a series of localities recorded in Sessé's notebook of 1791. He spelled the name "Yztcuintla."

Santo Desierto: see Desierto de los Leones.

Santo Tomás: see Hostotipaquillo.

San Vicente, [Salvador] 13°38′ N., 88°48′ W.*

See Salvador. Presumably this is the place mentioned in FGU under the name Vincentopolis.

Sararacua: see Uruapan.

Sayula, [Jal.] 19°52′ N., 103°36′ W.*

About 25 km NW of Zapotlán [Ciudad Guzmán]. The "Third Excursion" passed through here, probably in late February, 1791, en route from Colima to Guadalajara, q.v. In PNH (ed. 2, p. 40) there is apparently a misprint: "in . . . temperatis Saytilae agris."

Servatoropolis

Same as San Salvador. In FGU there are at least 32 references to "Servatoropolis suburbiis, montibus," etc. See Salvador.

Sinaloa, [Sin.] 25°50′ N., 108°14′ W.*

Vistied by the botanists of the "Third Excursion" during the autumn of 1791; see text, p. 133. The references in FM are "Habitat prope Oppidum Sinaloae," and "in umbrosis *Sinaloae* montibus." In the S. & M. herbarium, 2 specimens are labelled "Sinaloa" and two others bear the epithet *sinaloense.*

Socoltenango, [Chis.]: see Xocoltenango.

Sonsonate, [Salvador] 13°43′ N., 89°44′ W.*

See Salvador. In FM there is one published reference to this place, "in Sonsonate montibus." In FGU there are at least 9 references to it.

Sonzacate, [Salvador] 13°44′ N., 89°43′ W.

See Salvador; in FGU the reference is to "Sonsacate sylvis prope Sonsonate." Sonzacate is 2–3 km NE of Sonsonate.

Soquillo: see Luquillo.

Sotavento, Costa de: see text, p. 141.

Sultepec, [Méx.] 18°52′ N., 99°57′ W.*

An important mining center about 20 km SSE of Temascaltepec, q.v. Sessé and Castillo visited this part of Mexico in 1792, but apparently the only published reference to Sultepec is in PNH (ed. 2, p. 78): "in temperatis Temascaltepec et Sultepeci montibus." As PNH was written in 1791, the reference to Sultepec evidently is based on some previous visit. Mociño was a native of Temascaltepec, so such a visit was not unlikely.

Tabasco

See Ahualulco, Ocoapán, and text, p. 142. In the S. & M. herbarium *Gonolobus* sp. and *Gonzalagunia panamensis* bear the epithet *tabascensis.*

Tacubaya, [D.F.] 19°24′ N., 99°12′ W.*

Now in the congested urban area of Mexico City, hardly 5 km WSW of the center. The reference in PNH is "in . . . Tacubayensi Archiepiscopali horto."

Tagarnana, antrum (or caverna) de, [Cuba]

In the central city of Havana, q.v., not far west of the harbor. References in FM are several, including "ad litora maris prope antrum de Taganana [sic], Habanae"; "inter rupes mari vicinas, ante Puellarum refugium et Antrum de Tagarnana"; "rupes cavernae de Tagarnana," and "rimis Antri de Tagarnana."

Tarahumaria alta: see Canelas.

Tarímbaro, [Mich.] 19°47′ N., 101°08′ W.*

About 10 km N of Morelia. The "Third Excursion" probably passed through here in early August, 1790, en route from Guanajuato, q.v., to Morelia. The reference in PNH is "in Tarimbari clivis."

Tehuacán, [Pue.] 18°27′ N., 97°23′ W.*

On the main route between Puebla and Oaxaca; Mociño stopped here en route, Oct 1795. Citations in FM are "in aridis Tehuacani circuitibus"; and "inter Tehuacam et Oaxacam prope iter." In the S. & M. herbarium *Cyphomeris gypsophiloides* and *Tetraclea coulteri* are labelled as from Tehuacán, and *Solanum lanceolatum* bears the epithet *tehuacanense.*

Tehuantepec, [Oax.] 16°20′ N., 95°14′ W.*

Mociño stopped here en route to Central America for about 3 months (Feb–May 1796), and again on the return (Dec 1798). See Chiapas, Estado. In the S. & M. herbarium *Croton niveus* is labelled by Mociño "Copalchi de Tehuantepeq[e]." *Croton soliman* is marked "Tehuant[epeque]." In FGU there are 3 references to "Tehuantepeci montibus."

Telpepae: see Tepelpa.

Temascaltepec, [Méx.] 19°02′ N., 100°01′ W.*

About 50 km SW of Toluca. Sessé and Castillo drew their salary here on 4 Aug 1792, having come from México via Toluca; see text, p. 138. From here they continued to Valle de Bravo, Malacatepec, and Zitácuaro. Places in the region of Zitácuaro, also cited in FM, are Los Laureles, Nandio, and San Mateo. For the presumed return route to México see text, p. 138. Also cited in FM, in connection with Temascaltepec, are San Francisco, "justa Fodinas Temascaltepec"; San Andrés del Valle, "haud procul Temascaltepec"; and the road to the "ambulacrum S. Jacobi." More than 25 species from the mountains of Temascaltepec are cited in FM. See also Sultepec.

Temascatío, [Gto.] 20°41′ N., 101°16′ W.*

About 15 km NW of Salamanca; the botanists and artists of the "Third Excursion" passed through here, probably in late July 1790, en route from Guanajuato, q.v., to Morelia. References in PNH are "in Temascatio, prope Guanaxuatum"; "in praedis Temascatio, prope Salmantinam."

Temisco, [Mor.] 18°50′ N., 99°14′ W.*

Not on most modern maps, but according to Alvarez & Duran (1856), "Temixco" was 2 leagues S of Cuernavaca, q.v. The references in PNH include "Temisci praedio," and "prope Quauhnahuacam in Temisci haereditate."

Tenampulco, [Pue.] 20° 10′ N., 97°24′ W.*

Ca. 30 km S of Papantla, Ver. Sessé and Castillo passed this place Aug–Oct 1792; see Veracruz, Estado. The locality is cited in FM as Tenanpulco, or "in . . . montibus de Tenampulco et Espinal," or "in montibus calidarum regionum, ut Tenampulco prope Huastecam." A variant spelling is Tenampultzi.

Teopisca, [Chis.] 16°31′ N., 92°29′ W.*

See Chiapas, Estado. In FGU there are at least 17 references to Teopisca alone, one to "montibus Teopiscam a Civitate Regia separantibus." See also San Bartolomé. This place is about 30 km SE of San Cristóbal de las Casas, on the road to Comitán.

Tepalcatepec, [Mich.] 19°05′ N., 102°51′ W.*

About 60 km W of Apatzingán, q.v.; the "Third Excursion" visited this place on 2 Jan 1791, en route to Coahuayana. There are numerous references in PNH, including e.g. "calidioribus circuitibus Tepaltepeci," and "in montibus inhospitalibus ab oppido Tepalcatepec Coahuayana usque interjectis" (in at least two places in FM the word Temascaltepec is substituted, evidently by a slip of the pen, for Tepalcatepec, thus: "montibus inter oppidum Temascaltepec Coahuayanamque interjectis"). The name is sometimes spelled Tepalcatepeque in PNH.

Tepango, [Pue.]: see San Antonio de Tepango.

Tepeaca, [Pue.] 18°58′ N., 97°54′ W.*

About 35 km ESE of Puebla. Not cited in PNH or FM, but in the S. & M. herbarium *Salvia axillaris, Bouvardia erecta* and *Buchnera pusilla* are labelled as from Tepeaca. The collector in each case may have been Ignacio León, for whom see p. 181.

Tepechicotlán, [Gro.]

Shown on the map of Guerrero (ca 1975) in the collection called *Librería Patria,* located about 10 km SE of Chilpancingo. Presumably visited during the "Second Excursion," to Acapulco in 1789; the reference in PNH (ed. 2, p. 27) is "in Tepechicotlani montibus."

Tepecoacuilco, [Gro.] 18°18′ N., 99°29′ W.*

About 10 km SE of Iguala. Presumably visited in the course of the "Second Excursion," to Acapulco in 1789, but not mentioned in PNH; see text, p. 128. The reference in FM is "in montibus Tepecuaculci."

Tepelpa, [D.F.]

Now well within the urban area, west of San Angel and 10–12 km SW of the center of Mexico City. In PNH often cited as near México, e.g. "in Tepelpae collibus prope Mexicum." Presumably the same locality is meant in PNH where the reference is "in Tepetlpae montibus prope Sancti Angeli oppidum"; "Tepetlpa, Mex." was also included among the localities listed by Sprague (1926, p. 424). "Terepae" (PNH ed. 1, p. 35) was corrected to "Tepetlpae" in ed. 2, p. 33, and "Telpepae" to "Tepelpae" (ed. 1, p. 48; ed. 2, p. 45).

Tepetitán, [Salvador] 13°39′ N., 88°50′ W.*

See Salvador; in FGU the reference is to "Tepetitam declivibus." The place is about 5 km WNW of San Vicente.

Tepetlapa, [Oax.] 17°37′ N., 98°23′ W.*

About 5 km NE of Nejapan, q.v., and 20 km ENE of Tlapa, Gro. Not certainly the place mentioned in PNH, "ad margines fluvii Tepetlapae" and in FM (where spelled Tepetlapac), but probably so because of the coincidence of several places mentioned in PNH, near Tlapa, q.v., but not otherwise identified.

Tepetlpa: see Tepelpa.

Tepic, [Nay.] 21°30′ N., 104°54′ W.*

The botanists and artists of the "Third Excursion" probably reached Tepic early in August, 1791; see text, p. 132. From that place they took the lowland road by way of Santiago Escuintla, Acaponeta, Mazatlán, Culiacán, and the city of Sinaloa, to Alamos, Sonora. Sessé probably returned to México through Tepic early in 1792 by the same road. The artists Cerda and Echeverría were in Tepic on 15 Feb 1792; Mociño probably passed through about the same time on his way to San Blas, and again on his return from Nootka, in Feb 1793; see text, p. 137. Longinos Martínez, with Senseve, reached Tepic about the first of April, 1791, and probably worked for the rest of that year in the San Blas-Tepic region; see text, p. 134. Both men were in Tepic again in Feb 1793, and Longinos remained in the region until December of that year. There are a few references to species from Tepic in FM, and in the S. & M. herbarium *Euphorbia strigosa* bears the epithet *tepicensis.*

Tepoxtlán, [Mor.] 18°59′ N., 99°06′ W.*

About 15 km ENE of Cuernavaca, q.v. Presumably the "Second Excursion" visited here during their stay in Cuernavaca in 1789. The reference in PNH is "in calidis et temperatis Tepostlani et Sayulae circuitibus." Probably the references to the two distant localities are coincidental. In FM the name is spelled "Tepotztlani," and in PNH (ed. 1, p. 96) "Tepostlanu."

Tequila, [Jal.] 20°54′ N., 103°47′ W.*

The "Third Excursion" passed through here, probably in early August 1791, en route from Guadalajara, q.v., to Tepic. In FM there are at least 3 references to Tequila.

Terepae: see Tepelpa.

Tesmeluca: see San Martín.

Tetela: see Santa María.

Tetitlán, [Nay.] 21°08′ N., 104°36′ W.*

About 15 km W and somewhat N of Ahuacatlán, more or less on the road between that place and Tepic; see Tepic, and text, p. 132. The botanists of the "Third Excursion" probably passed through here in mid-summer of 1791. The reference in FM is "in Tetitani [sic] montibus," so may pertain to some other place, but I cannot find it.

Texcoco, [Méx.] 19°31′ N., 98°53′ W.*

About 25 km ENE of the center of Mexico City. See Calpulalpan. The references to this place are not in PNH, but in FM, e.g. "in itinere de *Tezcuco ad Capulalpa,*" and "in aridis montibus Texcuco et Capulalpa interpositis."

Teziutlán, [Pue.] 19°49′ N., 97°21′ W.*

About 70 km S of Papantla, Ver., q.v., and 55 km NW of Jalapa; see text, p. 139. Possibly visited by Sessé in 1792. The reference in FM is "in montibus calidis Teuzitlani."

Tingambato, [Mich.] 19°30′ N., 101°52′ W.*

About 15 km ENE of Uruapan. The "Third Excursion" passed through here en route from Pátzcuaro to Uruapan and Apatzingán, q.v., in Sep 1790. In PNH the name is spelled "Timgambato" and "Tigambato." In FM the reference is "in itinere a Tingambato in Uruapam ducente."

Tixtla, [Gro.] 17°35′ N., 99°26′ W.*

Less than 10 km NE of Chilpancingo, and about 20 km W of Chilapa, where the "Second Excursion" was based from about Aug to Oct, 1789; see text, p. 128. The reference in FM is "in montibus frigidiusculis Tixtlae vicinis."

Tlacotalpan, [Ver.] 18°37′ N., 95°40′ W.*

About 20 km SE of Alvarado, q.v., and 80 km SE of Veracruz. Cited in FM as "in paludosis . . . Tlacotalpae locis." In the S. & M. herbarium a species of *Solanum* bears the epithet *tlacotalpense*. The same species is cited in FM; "ad fluviorum Tuxtlentium ripas." Mociño presumably passed through here in 1793, en route between Veracruz and Tuxtla.

Tlacotzotillam: see Tlalcozotitlán.

Tlalcozotitlán, [Gro.] 17°54′ N., 99°15′ W.*

About 30 km N of Chilapa, q.v. The reference in PNH is "in montibus de Tlacotzotillam prope iter del Copalillo." "Tlacotzotillam" is apparently a printer's error for Tlacotzotitlam.

Tlalpan: see San Agustín.

Tlalnepantla, [Méx.]

Now at the edge of the urban area of Mexico City, about 15 km N of the center. Not cited in PNH or FM; the "Third Excursion" passed through on the way to Querétaro, 18 May 1790.

Tlaltenango, [Mor.] 18°56′ N., 99°15′ W.*

Not located on a map. According to Alvarez & Duran (1856, p. 64), it was N of Cuernavaca, q.v., on the road to México: "desde Huitchilac descenso violento, se caminan tres leguas hasta Tlaltenango, y luego sigue plano hasta llegar a la ciudad de

Cuernavaca." In PNH the references are: "in hortis Tlaltenango prope Quahuahuacam," and "in Ayacapixtla et Tlaltenanco."

Tlapa, [Gro.] 17°33′ N., 98°33′ W.*

In eastern Guerrero, about 15 km from the boundary with Oaxaca, and 100 km E of Chilpancingo. It may be that some of the botanists of the "Second Excursion" made a side-trip to this area while the party was based in Chilapa in the autumn of 1789, or that they returned to México by this route. See text, p. 128, and Hucitantenango, Nejapan, and Tepetlapa.

Toa Alta, [P.R.] 18°23′ N., 66°15′ W.*

About 15 km WSW of San Juan. Apparently Sessé visited this place early in the summer of 1796, before crossing the island to the south side; see Puerto Rico. Also spelled Zoa Alta. In FM the references are: "in umbrosis montibus de Toa Alta de Tabasco," "in Praedio de Josefo Garcia juxta iter de Toa Alta ad Saibanito interjectum," and "in anfractu de Saibonito haud procul a Praedio Domini Colon in Insula de Porto Rico." See text, p. 144.

Toluca, [Méx.] 19°17′ N., 99°40′ W.*

A little more than 50 km WSW of Mexico City, across a pass of about 3000 m elevation. First visited in Dec 1787 (see text, p. 125), and subsequently (in 1792) by Sessé and Castillo (text, p. 138). Toluca and the Volcán de Toluca are cited in FM, as is the Praedium de la Huerta, near Toluca.

Tomatlán, [Mich.] 19°12′ N., 102°36′ W.*

About 30 km W of Apatzingán, q.v. The "Third Excursion" passed through here en route to Coahuayana in Dec 1790. There appear to be no indubitable references to this place in PNH, but *Justicia ciliaris* is reported from "prope Tomatam."

Tonila, [Jal.] 19°26′ N., 103°31′ W.*

The "Third Excursion" passed through here, en route from Coahuayana to Guadalajara, qq.v., in February 1791; see also Volcán de Colima. Tonila is situated on the edge of a deep barranca, which may explain the reference in PNH, "prope Tonilam in anfractuosis ac asperis locis."

Tospa, [Ver.]

Not precisely located, but from citations in FM evidently in the Córdoba-Orizaba region. It is possible that "Tospa" is itself a corruption of "Tuxpan," a rather common place-name in Mexico. The reference "in Praedio de *Tospa* aut S. José de la Laguna, juxta Orizava," suggests that San José was an alternative name for the same place. Other references in FM are "in Praedio Tospa juxta Cordovam," and (presumably in reference to the same San José), "in agris Cordovae et in Praedio S. Josephi."

Toto, El: see Cuernavaca.

Totonaci, indians

See Veracruz, Estado. References in FM to the "Totonaci" and "montibus Totonacis" apply chiefly to localities in an area bounded by Espinal and Coxquihuí, Ver., Huehuetla, Pue., Zozocolco, Ver., and Tenampulco, Pue.

Totonicapán, [Guatemala] 14°55′ N., 91°22′ W.*

See Guatemala. In FGU there are at least 19 references to this place, indicating that Mociño must have paused here either before reaching Guatemala City in 1796, or on his return from Nicaragua in 1798.

Toxocolo

I find no place of this name, and suppose it to be a corruption of Zozocolco

["Xoxocolco"], q.v. The reference in FM is "in Toxocolo, Izcatatuat? dictum a Totonacis indis."

Tulancingo, [Hgo.] 20°05′ N., 98°22′ W.*

About 35 km E of Pachuca. It is presumed that Sessé and Castillo began here a trip to northeastern Veracruz, probably in August 1792; see Veracruz, Estado.

Tumacao: see Humacao.

Tuna, [P.R.]

Not precisely located. Probably visited by Sessé in May or June, 1796; see Puerto Rico, and text, p. 144. The reference in FM is to a place between the "town" [Oppidum] of Tuna, and the "hacienda" [Praedium] of Camuy. Tuna does not appear on most modern maps, but some maps show a Punta de la Tuna, on the coast W of Camuy.

Tunaco: see Humacao.

Tustla: an alternative spelling of Tuxtla, q.v.

Tuxtla [Gutiérrez, Chis.] 16°45′ N., 93°07′ W.*

See Chiapas, Estado. In FGU there is one reference "in Tuxtlensis Chiapae praedii versus Tabascum situ." In the S. & M. herbarium about 9 specimens bear the epithet *tuxtlensis,* or are labelled "in Tuxtlae montibus." One (*Croton niveus*) is labelled "Copalchi de Tuxtla de Chiapa."

Tuxtla, [Ver.]: see San Andrés, and Tlacotalpan; see also Tuxtla, [Chis.].

Tzararaqua, Tzarazaqua: see Uruapan.

Uruapan, [Mich.] 19°25′ N., 101°58′ W.*

The "Third Excursion" passed through here and worked some days in the vicinity, about the end of September, 1790; see text, p. 131. They visited the cataract of Zararacua, near Jucutacato, less than 10 km SSW of Uruapan, before leaving for Ario and Apatzingán, q.v. Citations in PNH are "prope Uruapam," "secus decursum aquarum e Jucutacati cataracta Tzararaqua dicta in oppido Uruapam effluentium." In FM the reference is "prope descensum cataractae spectabilis in oppido Uruapam dicta *Sararacua,* id est Aquae collatorium." The spellings "Iucutacato," "Tzarazaqua," and "Zararacua" also occur. In the S. & M. herbarium a specimen of *Begonia* bears the epithet *uruapensis.*

Valladolid: see Morelia.

Valle de Bravo, [Méx.] 19°11′ N., 100°08′ W.*

About 50 km S of W of Toluca. Sessé visited here, probably in late July 1792; see Temascaltepec, and text, p. 138. Citations in FM are "in montibus de Temascaltepec ad oppidum del Valle interpositis," and "in montibus et oppido del Valle ad Malacatepec interpositis." Sprague (1926, p. 424) supposed that *Oppidum del Valle* referred to Valle de Santiago, q.v. In 1792 the name known to Sessé was that cited in FM: "in oppido S. Andres de el *Valle* haud procul Temascaltepec." Valle de Bravo appears simply as "Valle" on some maps well into the middle of the 19th Century.

Valle de Santiago, [Gto.]

A locality about 20 km S of Salamanca, cited by Sprague (1926, p. 424) as one of those visited by Sessé and Mociño. A place called El Valle is cited several times in FM; this is now called Valle de Bravo, q.v.; it was visited by Sessé in 1792. The name El Valle does not appear in PNH, the manuscript of which was completed in 1791.

When the "Third Excursion" passed from Guanajuato, q.v., to Morelia, in 1790 they probably went directly from Salamanca to Parangueo, thus somewhat to the west of Valle de Santiago.

Vallisoletum: see Morelia.

Veracruz, Estado

Sessé, with Castillo, seems to have left Tulancingo, Hgo., in ?August 1792, thence travelled by Zacatlán [Pue.], San Antonio de Tepango, [Pue.], San Bernardino [Pue.], Hueytlalpan, [Pue.], Huehuetla, [Pue.], Zozocolco and Coxquihuí, [Ver.], Tenampulco, [Pue.], and Espinal, [Ver.], to Papantla, [Ver.]. The dates given for these places in FM are from August to October. The two men, with the artist Cerda, drew their salary in Jalapa on 2 Nov. See Hidalgo. The many references in FM to the "Totonaci" and "montibus Totonacis" refer chiefly to the localities in the area between Espinal and Zozocolco. Sessé moved from Puebla to Orizaba about 1 July 1793; he seems to have worked near Córdoba and Orizaba until mid-October. During this time he visited Perote and presumably Jalapa, Tospa, and San Andrés. Mociño was in Córdoba 31 Jul 1793, then left for Tuxtla, where he ascended the active volcano on 23 Sep and 21 Oct. He worked out of San Andrés Tuxtla in Oct and Nov, visited Tlacotalpan and Acayucan. He returned to Veracruz [City] on 22 Feb 1794, then apparently re-established himself in San Andrés, where he was on 3 Aug 1794, apparently on his way to Tabasco, q.v. He seems to have gone by way of Acayucan and Cozoliacaque to Coatzacoalcos, thence into Tabasco, whence he seems to have returned in December.

Veracruz, [Ver.] 19°12′ N., 96°08′ W.*

Cited by Sprague (1926, p. 424) as a Sessé & Mociño locality. References in PNH are to Linnaean localities, as under *Boerhaavia erecta*: "Habitat Veracruce et oppido Apatzingan." Sometimes this is very direct, as under *Heliocarpus americana*: "Habitat in Veracruce, calidiisque aliis Novae Hispaniae regionibus." In FM, however, there are additional references that may well indicate collections made at this place by Sessé or Mociño, e.g. under *Tabernaemontana veracrucensis,* "prope Veracrucem."

Viejo, El, [Nicaragua] 12°38′ N., 87°11′ W.*

See Nicaragua. In FGU there are references to "Oppido del Viejo" and "montibus del Viejo." The tall mountain called Cerro Viejo (12°42′ N., 87°01′ W.*), is about 15 km NE of Chinandega, q.v.

Vinapa, [Sin.] 24°13′ N., 107°01′ W.

About 75 km SE of Culiacán, on the route traversed by the "Third Excursion" in 1791, and listed in Sessé's notebook of 1791; see text, p. 133.

Vincentopolis, [Salvador]

See Salvador, Cojutepec, and San Vicente.

Volcán de Colima, [Jal.]

After leaving the city of Colima, the "Third Excursion" passed Tonila near the border of modern Jalisco, then skirted the eastern base of the volcano before arriving at Zapotlán, about 35 km north of Tonila. References in PNH include "ad margines rivulorum ex Colimensi Vulcano effluentium," and "Habitat Tonila prope Colimensem Vulcanum." See text, p. 132.

Volcán de Orizaba [Citlaltepetl, Ver.-Pue.]

See Orizaba, and San Andrés. The reference in FM is "in medietate Vulcani altissimi de Orizava." There is nothing known to me except this statement, to indicate that the botanists actually worked on the volcano itself, although Sessé spent the summer of 1793 within sight of it.

Volcán de Toluca, [Méx.] 19°08′ N., 99°44′ W.*

The Nevado de Toluca (elev. 4578 m) is about 20 km SSW of the city of Toluca. Sessé and Castillo visited the mountain in the summer of 1792 (see text, p. 138) and ascended to above timberline. Cited in FM as "in Vulcano Tolucae" or "Vulcano Tolucense."

Xalpatagua, [Guatemala]

So cited in FGU; same as Jalpatagua; see Guatemala.

Xochiatlan, [Pue.]

Not precisely located; the reference in FM is "Oppidis S. Bernardi de Xochiatlam et Hueitlalpae." The presumption is that San Bernardo was a place near Hueytlalpan, and was visited by Sessé and Castillo in 1792. Modern maps show a place called Eloxochitlán, about 15–20 km W of Hueytlalpan; this could conceivably be the locality cited in FM. See Hueytlalpan, and Veracruz, Estado.

Xochitepec, [Mor.] 18°47′ N., 99°14′ W.*

About 15 km S of Cuernavaca, q.v. The reference in PNH is "in montibus Xochitepeci." In the S. & M. herbarium *Physodium dubium* is labelled "in mon[tibus] Xo[c]hitepec."

Xochitlán, [Mor.] 18°52′ N., 98°49′ W.*

About 5 km E of Yecapixtla. Probably visited in 1788 and 1789; see text, p. 126. In PNH there are at least 11 references to this place, all dated Sep–Dec. Various spellings are Xochistlam, Xochistlan, Xochitlam, Xochixtlan. The reference to "Nochiztlan" (PNH ed. 2, p. 4) is probably an error for Xochiztlan.

Xocoltenango, [Chis.]

See Chiapas, Estado. In FGU there is one reference to "montibus Xocoltenangi oppidum in Chiapensi Provincia." Not located, but perhaps the same as Socoltenango, a place about 15 km W of Comitán. Mociño seems to have passed from San Cristóbal las Casas to Comitán by way of Teopisca and San Bartolomé, q.v., thence presumably through Socoltenango, at 16°13′ N., 92°15′ W.*

Xorullo, [Mich.]: see Jorullo.

Xotipec

Not located; perhaps a corruption of Xochitepec, q.v. The reference (in FM, ed. 2, p. 232), is "Habitat calidis N. H. agris ut Xotipec."

Xoxocolco, [Ver.]: see Zozocolco.

Yaqui, Río, [Son.]

Sessé (cf. Rickett, p. 29, and text, p. 133) explored Sonora as far north as the "missions on the Río Jacqui," i.e. presumably more than 100 km NW of Alamos, where he was in October, 1791. Sessé then returned from Sonora to Rosario, early in 1792. In the S. & M. herbarium *Agonandra obtusifolia* is labelled "arenosis litoribus prope Jacqui (fl. Nov.)."

Yauco, [P.R.] 18°02′ N., 66°51′ W.*

Sessé visited here, probably in June 1796; see Puerto Rico, and text, p. 144. The reference in FM is "in montibus Yauco in Insula de Porto Rico."

Yecapixtla, [Mor.] 18°53′ N., 98°52′ W.*

About 30 km W of S of Amecameca. The "First Excursion" worked from a base here during the first attempt to explore the "tierra templada" in the autumn of 1788. See text, p. 125. Variously spelled by the botanists, and in PNH and FM, as

Ayacapiztla, Ayacapixtla, Iacapixtla, or Yacapixtla. Sprague (1926, p. 423) spelled it Ayacapistla or Ayacapixtla, and placed it in the State of Mexico.

Yztcuintla: see Santiago Ixcuintla.

Zacatecoluca, [Salvador] 13°30′ N., 88°52′ W.*

See Salvador. In FGU there is a reference to "Zacatecolucae maritimis, ad Praedium Escuintla dictum."

Zacatlán, [Pue.] 19°56′ N., 97°58′ W.*

About 50 km SE of Tulancingo, Hgo.; Sessé and Castillo visited here, Aug–Oct 1792; see Veracruz, Estado. The full name of this place is Zacatlán de las Manzanas, and it may be so cited by Sessé & Mociño (cf. FM, ed. 2, p. 65).

Zacualpa, [Guatemala]

So cited in FGU; same as Azacualpa; see Guatemala.

Zalatitlán

Not located. The references in FM are "prope Termas Zalatitlanenses," and "in anfractu de Zalatitlani." Very probably "in anfractu de Zulatitlan" (FM, ed. 2, p. 135) refers to the same place. Possibly the name is a corruption of Zapotitlán, which is not an uncommon place-name in Mexico.

Zapaluta, [Chis.] 16°07′ N., 92°03′ W.*

See Chiapas, Estado. About 15 km SE of Comitán. In FM (ed. 2, p. 141) there is a reference "in saxosis Zapalutae clivis."

Zapotlán, [Jal.] 19°41′ N., 103°29′ W.*

Now known as Ciudad Guzmán. The "Third Excursion" passed through here in mid-February, 1791, en route from Colima to Guadalajara, q.v. In PNH there is a reference, "in Zapotlami . . . hortis."

Zararacua, Cascada de: see Uruapan.

Zitácuaro, [Mich.] 19°24′ N., 100°22′ W.*

Sessé and Castillo visited here, probably in August 1792; see Temascaltepec, and Malacatepec. Other places near Zitácuaro, cited in FM, are Los Laureles, Nandio, and San Mateo. One reference in FM is "in agris Citacuari."

Zitlala, [Gro.] 17°38′ N., 99°05′ W.*

About 10 km N of Chilapa, q.v. Visited in the autumn of 1789. Variously cited in PNH: "in calidis Zitlalam montibus jurisdictionis Chilapae," "in Zitlatlae montibus," "in Citlatae [sic] montibus."

Zoa Alta: see Toa Alta.

Zoquitlán, [Oax.] 16°33′ N., 96°23′ W.*

About 70 km SE of the city of Oaxaca, q.v. Mociño passed through here on 20 Jan 1796, en route to Tehuantepec.

Zozocolco, [Ver.] 20°07′ N., 97°34′ W.*

About 45 km SW of Papantla. Sometimes spelled Tzotzocolco or, in FM, Xoxocolco. Sessé and Castillo passed this place, probably Oct 1792; the reference in FM is "fructus fere maturos Octobri observabimus"; see Veracruz, Estado.

Zulatitlán: see Zalatitlán.

Zumpango, [Méx.] 19°48′ N., 99°06′ W.*

About 40 km N of the center of the city of Mexico. The reference in PNH is "in paludis Zumpango."

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ABBREVATIONS USED IN THIS PAPER

AGH	Archivo General de la Nacion (Historia) [México].
ATLAS	Atlas Geográfico de la República Mexicana; for complete reference see text, p. 191.
FGU	"Flora Guatemalensis," a title given for convenience in this paper to Mociño's untitled and unpublished manuscript at MA (4ª Div., núm. 13).
FM	Flora Mexicana; for complete reference see text, p. 117.
MA	Madrid, archives of the Instituto Botánico "A. J. Cavanilles."
PNH	Plantae Novae Hispaniae; for complete reference see text, p. 112.
S. & M.	Sessé & Mociño; used in the phrase "S. & M. herbarium" to refer to the original set of herbarium specimens (at MA) collected by the members of the Botanical Expedition.

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by

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University of Washington, Seattle

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INTRODUCTION

Worldwide in distribution, the Cyperaceae include approximately 72 genera and 4000 species (Koyama, 1961; Cronquist, 1968). The family is thought to have evolved within the last 90 million years during the Tertiary Period (Raven & Axelrod, 1974) in tropical and subtropical regions where the greatest diversity of generalized or primitive genera currently exists. Subsequent migration has distributed taxa both northward and southward. The majority of species is located in the cool regions of both hemispheres, chiefly because the largest, most specialized genus *Carex* consists of more than 1100 species and commonly occurs in temperate to arctic latitudes. *Cyperus,* along with less specialized genera, is primarily centered in subtropical and tropical zones. The respective distributions of *Carex* and *Cyperus* attest to the fact that morphological specialization in the Cyperaceae has apparently accrued with migration away from tropical regions. The plants in the family are herbaceous, wind pollinated monocots that mostly occur in open communities of marshes or wet meadows. The features that characterize the family are typically triquetrous solid stems, three-ranked leaves with closed sheaths, reduced bisexual flowers borne in spikelets and subtended by scales, perianth segments absent or modified as bristles or scales, basifixed anthers, and one-seeded indehiscent fruits. Classification within the family has been influenced by these trends: 1) change from unifacial to bifacial leaf blades, 2) change from undifferentiated to differentiated prophylls, 3) change from cymose to spicate spikelets, 4) change from continuous to jointed rachillas, 5) change from spirally arranged to distichous scales in the spikelets, 6) loss of perianth bristles or scales, 7) change from bisexual to unisexual flowers, 8) loss of one or two stamens, and 9) loss of one carpel. The extent of variation of many of the species is still inadequately known and has led to disagreement about recent classifications of the family. In most schemes, cyperologists have recognized between two and four subfamilies with four to seven tribes.

Cyperus is the second largest genus in the family, comprising at least 550 species and perhaps as many as 900. All of the recent classificatory systems include *Cyperus* in tribe Cypereae of the subfamily Scirpoideae (Kükenthal, 1936; Mattfeld, 1936; Ohwi, 1944; Koyama, 1961). In his generic monograph of *Cyperus,* Kükenthal (1936) recognized six subgenera encompassing 61 sections. The sections were primarily delineated by the nature of branching of the compound inflorescence, extent of development of the rhizomes, and the number of stamens and carpels per flower. My recent studies have shown that many of Kükenthal's sections need revision before a natural classification of the genus can be proposed. Regional studies are decidedly less valuable in large genera such as *Cyperus* that have successfully utilized long-distance dispersal as well as gradual processes of short-distance migration and specialization; it is especially important in these groups to investigate purportedly phylogenetic units if species relationships are ever to be fully assessed.

Six of the species included in section Luzuloidei by Kükenthal (1936) are here excluded (see Excluded or Extralimital Names); the remaining fifteen taxa originally classified in the section are native to North and South America and appear to form a natural evolutionary group. Until enough information can be acquired to enable better sectional delineation in the genus, I will refer to this collection of taxa as the Luzulae group. Other studies (McGivney, 1938; Ayers, 1946) have dealt with some of the

North American taxa included here, but did not account for their overall morphological variation. In this study, the vegetative and reproductive structures of the taxa in the Luzulae group have been analyzed for their total range of distribution. These taxa are characterized by headlike clusters of spikelets, eglandular leaves, involucral bracts of unequal length, persistent rachillas continuous with the peduncle, three-veined deciduous scales, proximal abaxial groove on each of the scales, three-carpellate gynoecia, usually one stamen (seldom two) per flower, and brown or black achenes. The abaxial groove on the scales is either absent or inconspicuous in other complexes of *Cyperus.*

MORPHOLOGY

Habit. All taxa in the Luzulae group are herbaceous perennials in all or part of their geographic ranges. In the north temperate zone, the annual habit may occur in two species. *Cyperus acuminatus* is typically an annual distributed throughout the United States, but occurs as a short-lived perennial in the southern part of its range in Texas and Louisiana; and *Cyperus surinamensis* may be an annual in the northern part of its range in Kansas and Oklahoma, but is usually perennial from southeastern United States, south through Central America, and in South America.

All taxa are erect, herbaceous, and less than 120 centimeters tall. The two varieties of *C. reflexus* characteristically form scaly rhizomes, while the rest are tufted. Each of the erect, aerial stems bears several three-ranked leaves proximally, and a diffusely branched or contracted compound inflorescence terminally. The leaves have sheathing bases and ascending blades that are shorter than or equal to the length of the stem.

Prickle-hairs. The only type of epidermal "hair" found in the Luzulae group is the crystalline, unicellular prickle-hair, one that is ubiquitous in the Cyperaceae. The presence of these hairs on any organ brings about what is often termed a scabrous or scabrellate condition. Prickle-hairs are common to abundant on the margins of involucral bracts and leaf blades, but often abscise as the bracts and leaves age. In *Cyperus surinamensis,* the prickle-hairs are typically found on the distal one-half of the stems, and in *C. virens,* they are found on the three winged angles of the stem. Occurrence of prickle-hairs on the stems of other taxa is sporadic, but their presence may indicate previous hybridizations. In *C. acuminatus,* the stems are mostly smooth, but they are scabrellate on a few specimens, collected in Texas, that are putative hybrid derivatives between *C. acuminatus* and *C. surinamensis.* Prickle-hairs may also be found on the peduncles, bracts, and scales of the compound inflorescence.

Aerial stems. The mature stems (or culms) of the Luzulae group have a silicified epidermis, vascular bundles embedded peripherally in a chlorenchymatous cortex, and a hollow center. The ground tissue in the center of the young stem tears and disintegrates during development. All stems are a few millimeters broader at the base than just below the inflorescence. In cross-section, the stems may be round, roundly triquetrous, or triquetrous. Numerous longitudinal ribs and grooves extend the full length of the stem in all taxa, and are more conspicuous in stems that are round or roundly triquetrous than in triquetrous stems. Three species, *Cyperus eragrostis, C. intricatus,* and *C. virens,* have triquetrous stems, but only *C. virens* exhibits wings on the three prominent angles. The triquetrous and winged conditions of the stem appear to be specialized features in the Luzulae group.

Foliage leaves. The three-ranked leaves of the Luzulae group arise near the base of the stem, number three to thirteen, and have weakly differentiated sheaths and

blades. The leaf sheath is no more than one-third the total length of the leaf, membranous on the portion opposite the blade, and naturally closed (tubular). The basal diameter of the plant enlarges as new leaves are formed, causing the outer leaf sheaths to tear along their membranous portions. Reddish veins are characteristic of the sheaths of *C. reflexus,* and occasionally occur in *C. acuminatus, C. distinctus,* and *C. virens.* The blades are strap-shaped, typically wiry and coarse (thin and flexible in *C. acuminatus*), and with common to abundant prickle-hairs along the margins, at least when young. Of diagnostic importance, the sheath and blade show nodulose transverse septa in certain taxa; in the varieties of *C. virens,* these are conspicuous.

The usefulness of anatomical studies has been demonstrated in several studies (Metcalfe, 1969, 1971; Koyama, 1967). Several workers (Dunn, Sharma, & Campbell, 1967; Koyama, 1966, 1967) have reported that the stomatal complexes in various monocotyledons show little infraspecific variation, and Stebbins and Khush (1961) suggested that specialization of stomata in the Cyperaceae has proceeded from tropical to temperate areas. To analyze the anatomical characters of the Luzulae group, preparations were made of the upper and lower epidermis of leaves and involucral bracts of ten individuals of each taxon, following the methods of Metcalfe (1960). The cellular patterns, hairs, and stomates were studied for each. Since the anatomical characters of both epidermal surfaces of involucral bracts are comparable to those of foliage leaves, only the measurements of foliage leaves are given (Table 1).

The epidermal cells on both surfaces are arranged in lengthwise rows and have anticlinal walls that are sinuous and silicified. The rows are similar on the upper surfaces, but are differentiated abaxially into costal (overlying the vascular tissue) and intercostal zones. In each of the costal zones, the epidermal cells comprising the three to five rows of cells are smaller than those in the adjacent intercostal zones.

Table 1. Features of the epidermal surfaces of leaves. All measurements of length and width are in microns.

Taxon	Adaxial Epidermal Cells: l/w	Abaxial Epidermal Cells: l/w	Epidermal Cells in Stomatal Rows: l/w	Stomates l/w	Number of Silica Bodies per Cell
acuminatus	68–130/36–50	90–140/26–36	50–190/25–32	50–52/26–30	1–2 (–3)
distinctus	40–60 /18–28	95–165/10–30	50–80 /12–26	36–46/22–28	1–2 (–3)
eragrostis	75–120/25–30	50–125/20–30	55–80 /18–20	35–36/22–28	1–2
intricatus	45–150/20–30	75–125/20–25	50–75 /15–20	40–45/20–25	2–3
luzulae	34–100/32–40	32–84 /16–26	30–100/16–26	34–48/24–30	1
ochraceus	76–105/40–50	55–115/20–30	44–50 /20–28	36–46/24–30	1–2
pseudovegetus					
v. pseudovegetus	75–150/25–40	85–115/20–25	30–50 /15–20	35–40/20–25	1–2
pseudovegetus					
v. megalanthus	58–175/20–40	50–100/14–35	50–80 /14–25	30–36/24–30	3–7
reflexus					
v. reflexus	50–96 /36–50	50–96 /18–26	40–66 /22–32	32–36/20–36	1
reflexus					
v. fraternus	60–115/25–30	50–90 /15–25	35–50 /20–25	35–40/25–35	2–3
surinamensis	55–105/44–48	25–75 /22–26	30–72 /24–30	34–46/22–28	2
virens					
v. virens	30–42 /22–24	64–90 /26–30	34–76 /20–25	24–30/24–28	2–3
virens					
v. drummondii	70–110/35–40	50–105/33–35	30–50 /25–30	30–35/25–30	1–2
virens					
v. minarum	80–140/35–45	45–150/20–25	65–100/20–25	35–40/24–25	2–5
virens					
v. montanus	75–150/35–60	90–110/25–27	65–85 /25–30	35–36/25–30	1–2

There may be as many as twenty rows in each of the intercostal regions. Two to five stomatal rows usually occur in each intercostal zone and may be separated from each other by one or two nonstomatal rows and from the costal zone by one to five nonstomatal rows. The epidermal cells in the stomatal rows are smaller than those in the intervening nonstomatal rows (Table 1). On a single individual, the lengths of epidermal cells are comparable on both surfaces, while the widths of cells on the lower surfaces are generally smaller than those on the upper ones (Table 1).

Silica-bodies are formed only in the abaxial epidermal cells in the costal zone. They are conical, with the widest and basal portion attached to the inner periclinal wall and with the apex directed toward the outer periclinal wall; in surface view, they appear circular. Within the genera of the Cyperaceae, the number of silica-bodies per cell is known to have phylogenetic significance (Metcalfe, 1971). In the Luzulae group, the number of silica-bodies per cell is one to three for most of the taxa, indicating close affinities. The two exceptions are of purported hybrid origin, *C. pseudovegetus* var. *megalanthus* and *C. virens* var. *minarum,* and have three to seven and two to five silica-bodies per cell, respectively.

Stomates are found almost exclusively on the abaxial surface\ in the intercostal zone and appear circular or elliptic in outline. They are paracytic, with the narrow subsidiary cells nearly obscured by the large dumbbell-shaped guard cells. The size of the stomates in the temperate species (especially in *C. acuminatus, C. distinctus,* and *C. intricatus*) is usually greater than in taxa with wider or more tropical distribution patterns (Table 1).

Involucral bracts. The involucral bracts terminate the stem, and individually subtend the primary peduncles. They are unequal in length and usually number two to eight, but may be as numerous as forty, as in *C. pseudovegetus* var. *megalanthus.* The bracts mostly resemble foliage leaves, are often conduplicate, and either lack or have a minute sheath at their base. The lowermost involucral bract of *C. reflexus,* and occasionally of *C. acuminatus* and *C. intricatus,* is differentiated from that of other taxa in that it is wiry and mostly erect, and appears like a continuation of the stem. The nodulose transverse septa are conspicuous on the involucral bracts of the varieties of *C. virens* and either inconspicuous or absent in other taxa. As with foliage leaves, crystalline prickle-hairs occur on the margins but are often rubbed off or fall off with aging. Epidermal patterns of both bract surfaces are similar to those of foliage leaves. The only significant difference is that the size of cells on upper bract surfaces is greater than those on adaxial leaf surfaces.

Compound inflorescence. The compound inflorescence in the Luzulae group is composed of several to numerous peduncles, each terminated by clusters of spikelets called heads. Both the peduncles and the rachillas of the spikelets are branches and can be recognized by the presence of two modified basal leaves, namely an involucral bract or bracteole *and* a prophyll. The primary peduncles are subtended each by an involucral bract while the secondary and tertiary peduncles and the rachillas are subtended by bracteoles. All are ensheathed basally by a tubular prophyll which is located just above the subtending bract or bracteole. The size, shape, and number of veins of the prophylls are of significance in differentiating some species of the Luzulae group. The prophylls are also useful in understanding the relationships between genera of the Cyperaceae (Blaser, 1941, 1944; Koyama, 1961).

In most taxa, primary peduncles are common, secondary peduncles are occasional, and tertiary peduncles are infrequent to rare. When all of these are evident, the compound inflorescence exhibits a diffuse branching system, as in *C. virens* var. *montanus.* In all taxa, there are several branch systems within each head, most of which remain short and are not evident except by dissection or anatomical analysis. The failure of peduncles to develop does not seem to be particularly important

taxonomically, as such variability is noted in most taxa, often within a single population. In some taxa, though, the lack of primary peduncles is more common than their presence. Such compact inflorescences with sessile heads are often observed in *C. luzulae, C. reflexus,* and *C. surinamensis.* When the secondary or tertiary peduncles within a head fail to elongate, the head increases in size and is irregular in shape. The developmental stimulus that controls the formation of peduncles needs to be analyzed before the presence or absence of these structures can be used reliably in systematic studies. The standard "type" of compound inflorescence in the Luzulae group is one where the primary peduncles are well developed and the secondary peduncles weakly developed. Pedunculate heads, if present, are usually smaller and more numerous, and contain fewer spikelets than the sessile ones. Specialization in the Luzulae group appears to have involved both the reduction of primary and secondary peduncles to form a compact, sessile compound inflorescence, and the amplification of tertiary peduncles to create a diffuse branching system.

The ultimate branch system in the compound inflorescence is that provided by the spikelet. These are spirally arranged in tight clusters and aggregated to form heads. The number of spikelets per head varies within a taxon and depends on the extent of development of the branch systems. The spikelets in the Luzulae group are laterally compressed and usually ovate, and have two-ranked scales. All are characterized by the presence of a bracteole and prophyll at base. The spikelets show indeterminate growth since the scales and their enclosed flowers develop and mature acropetally. The rachilla is continuous with the peduncle and mostly straight, but sometimes is arched in the lowermost one-half when the spikelets are crowded to form a dense head. Only a few hyaline fragments may be left on the sides of the rachilla when the scales abscise. The raised scale scar on the rachilla is conspicuous, and can be used to determine the width of the proximal groove between the two keels on the scales and also to determine the distance between scales on one side of the spikelet. The development of the rachilla appears to be governed by a mechanism similar to the one that controls the length of the peduncles. Most spikelets are between 1.5 and 16 millimeters in length and bear fewer than 40 scales. *Cyperus ochraceus* is an exception, as certain of its populations may have spikelets up to 35 millimeters in length, with up to 88 scales. The larger spikelets in *C. ochraceus* could easily be produced by an elongation of the rachilla and the formation of more scales and flowers along it. Increased length of the rachilla appears to be a specialization of the spikelet. The angle of the scale's declension from the rachilla is also of taxonomic significance. In most taxa, the mature scales are declined 30°–60°, but in *C. ochraceus* they are usually perpendicular to the rachilla. The greater the angle of declension, the easier it is for an achene to become dislodged from its subtending scale.

Scales. The scales in the Luzulae group vary with respect to the proportion of their length and width, and their shape, texture, apex, attachment at the base, proximal abaxial groove, color, and margins. The two-ranked scales are borne on a quadrangular rachilla. The medial portion of the scale is fused along the widest portion of the rachilla, and the two sides of the scale are partially or completely fused to the narrow sides of the rachilla. The boat-shaped scale has a proximal groove, located between the two basal keels, that extends toward the apex. Where the groove ends, usually near the middle of the scale, the two keels dissipate or merge to form a single distal keel. Usually the back of the scale is slightly rounded distally. The nature of the scale apex is taxonomically useful in some taxa; the apex is incurved in *C. luzulae* and *C. ochraceus* and generally excurved in *C. acuminatus, C. pseudovegetus,* and *C. reflexus.* The texture of the scale often varies at different stages of its maturity. While young, the scale is typically light brown or yellow and possesses a membranous, reticulate, surface pattern. As the scale matures, it often deepens in color and becomes

smooth and glossy. Because of the acropetal maturation of the spikelet, both reticulate *and* smooth, glossy scales can frequently be observed in the same spikelet.

Each scale exhibits three prominent longitudinal regions. The subcartilaginous or firmly membranous, middle part of the scale is wider than the two keels and can be easily observed in lateral view. The three veins of the scale are found within this region and these may or may not coincide with the position of the keels. The membranous to crustaceous sides of the scale taper slightly toward the base. Only *C. distinctus, C. luzulae,* and *C. virens* have scales that are as broad at the base as at mid-length. In *C. ochraceus,* the scale base is wider than in most other taxa, and here the lateral sides are only partially attached to the rachilla.

The scales characteristic of the Luzulae group disarticulate from the rachilla acropetally. The scales of *C. distinctus* are tardily deciduous, whereas those of *C. intricatus* are often retained on the rachilla. The retention of scales and the transitional state of tardy disarticulation indicate a reduced dispersibility of the fruits. Predictably, the geographic distributions of both *C. distinctus* and *C. intricatus* are limited in scope.

Flowers. The bisexual flowers, each subtended by a scale, consist of one or two stamens and a tricarpellate gynoecium. The stamens represent an asymmetric whorl and are derived from a more generalized condition where there was one whorl with three stamens. The prototypic cyperaceous flower, however, is thought to have had six stamens arranged in two whorls (Blaser, 1941). When there is only one stamen per flower, it arises between the gynoecium and the scale, but the filament sometimes curves around the edge of the gynoecium and is appressed between the adaxial surface of the gynoecium and the rachilla. As an indication of structural symmetry on a single side of the spikelet, the stamen arises first from one side of the gynoecium, and then from the opposite side in the flower immediately above the first. When there are two stamens, as in *C. intricatus* and in some varieties of *C. virens,* they arise abaxially at the edges of the stipitate gynoecium, but the filaments invariably curve forward and are appressed between the rachilla and the gynoecium. The anthers develop while still enclosed and protected by the subtending scale; they become evident in anthesis when the filaments elongate and reach full length just prior to anther dehiscence. After dehiscing, the anthers dry and abscise. The compound, trigonous gynoecium has a trifid style that is deciduous as the fruit ripens and has a persistent base modified either into a narrow and short stipe or into a spongy and torulose structure as wide as the rest of the achene.

Fruits. The one-seeded indehiscent fruits are nutlets that are commonly called achenes. They range from two to seven times longer than wide, and are all trigonous. The mature size of the achene is typically achieved before its coloration and detailed surface pattern become evident. The surfaces are obovate, elliptic, or ovate in outline, and may be either concave, planar, or convex. The three surfaces are usually similar, but sometimes the two that are abaxial are of different shape or width than the adaxial one. Rarely, one of the abaxial surfaces is different from either of the other two. As a result, symmetry of the achene can be radial, bilateral, or irregular. Often there are inviable fruits that appear yellow, translucent and practically empty; these may occur in a spikelet along with plump viable fruits. Maturation and abscission of the achenes, as with the scales, proceeds acropetally. When ripe, the achenes fall from the rachilla, either before, after, or simultaneously with the scales and filaments; the achenes retain their stipitate or spongy base and apiculate tip when shed.

DISTRIBUTIONS

Distribution patterns of the fifteen taxa in the Luzulae group are correlated with morphological features of the reproductive structures. The shape, size, and orientation

of the scale that subtends a flower are correlated with the shape, dimensions, and dispersibility of the achenes. In the Luzulae group, increase in dispersibility is recognized by readily deciduous scales, reduced size of the achenes, and an increased angle of declension of scales from the rachilla (greater than 60°). Loss of dispersibility is associated with the retention of scales on the rachilla, enlargement of the achenes, development of an enlarged spongy and torulose base of the achene, and an angle of declension that is between 30° and 45°. Similar changes resulting in the loss of dispersibility of fruits and seeds have been noted for plants of insular floras (Carlquist 1966a, 1966b, 1974).

The taxa included in the Luzulae group are native to the New World and exhibit distribution patterns that are restrictive, disjunctive, or continuous. Geographically restricted taxa are represented by *Cyperus distinctus,* which occurs only in the southeastern United States and the West Indies, and has a large achene with an enlarged spongy base; and by *C. intricatus,* which occurs only in southern Brazil and northern Argentina, and has scales that do not readily disarticulate when mature. Of the taxa that occur both in North and South America, for example *C. luzulae,* the achenes are small and the scales readily disarticulate. Disjunctive patterns are provided by *C. virens* var. *drummondii* which occurs in Louisiana, Texas, Nicaragua, Jamaica, continental South America, and the Galapagos and by *C. eragrostis* which occurs naturally in the Pacific coastal zone of the western United States and the southern part of South America. The morphology of the scales and achenes of disjunctive taxa is similar to that of taxa with widespread continuous distributions. Possible explanations for apparently disjunctive patterns include: diminution of a once extensive distribution, long-distance migration, inadequate exploration or collecting, or multiple origins of the taxa. Extinction of intermediate populations of species that were at one time widespread appears to be the best explanation for the disjunctive patterns in *C. reflexus* and *C. virens.* Long-distance dispersal, however, may account for the north-south disjunction of *C. eragrostis.*

RELATIONSHIPS OF THE TAXA

The relationships of the fifteen taxa were assessed by evaluating those characters principally used in the descriptions of the taxa. To form the data base, 75 characters were tabulated (Table 2). Four analyses were then performed: 1) using all 75 characters; 2) using 20 "evolutionary" characters; 3) using the 17 vegetative characters; and 4) using the 58 reproductive characters. Two computer-assisted programs were employed to aid the analysis: a clustering routine, MINFO, and discrimination analysis.

MINFO is a polythetic, agglomerative, and hierarchical classification procedure using an information statistic (Orlóci, 1969). The program was provided by the Environmental Sciences Division at Oak Ridge National Laboratories and included documentation (Goldstein & Grigal, 1971) and a punched program deck. In this study, each taxon represents an OTU. During each clustering cycle, that pair of OTUs or group of OTUs is joined which results in the minimum information gain. The program continues to cluster until all OTUs are joined. Dendrograms may then be produced by connecting OTUs (taxa) at the appropriate level of mutual information. These depict the relative affinities of the taxa to each other.

The clusters of the MINFO program are subjected to SPSS Discriminant Analysis (Nie, et al., 1975) primarily to obtain a rank order of importance of the characters used as discriminators. Also provided is a matrix of Wilks Lambda values to test for significant differences between groups at each step; as these measures decrease, the significance for group separation increases.

When all 75 characters are used (Fig. 1), the two varieties of *C. reflexus* are separated, and *C. ochraceus* is questionably placed near *C. reflexus* var. *fraternus.*

Table 2. List of the 75 characters and their character states used in the two computer-assisted analyses. The first 17 characters are vegetative, and the remaining 58 are reproductive ones. The characters utilized in the "evolutionary" analysis are noted by an asterisk.

CHARACTER	CHARACTER STATE
*1. habit	annual, 0; tufted perennial, 5; rhizomatous perennial, 10
2. height (cm)	actual number (ave.)
*3. stem diameter	round, 0; roundly triquetrous, 5; triquetrous, 10
*4. stem surface	smooth, 0; scabrellate, 10
5. number of leaves	actual number (ave.)
*6. ratio of leaf length to stem length	actual number (ave.)
7. length of leaves (cm)	actual number (ave.)
8. length of leaf sheath (cm)	actual number (ave.)
9. color of leaf sheath	stramineous, 0; brown, 5; dark red or reddish purple, 10
*10. transverse septa on leaf sheath	absent, 0; sparse, 5; prominent, 10
11. width of leaf blade at mid-length (mm)	actual number (ave.)
12. number of involucral bracts	actual number (ave.)
*13. nature of involucral bracts	wiry, 0; foliaceous, 10
14. length of involucral bract (cm)	actual number (ave.)
15. width of involucral bract (mm)	actual number (ave.)
16. presence of sheath on involucral bract	absent, 0; barely present, 0.5; present but inconspicuous, 1.0
17. transverse septa on involucral bract	absent, 0; sparse, 5; prominent, 10
18. length of compound inflorescence (cm)	actual number (ave.)
19. number of primary peduncles	actual number (ave.)
20. length of primary peduncles (cm)	actual number (ave.)
21. width of primary peduncles (mm)	actual number (ave.)
*22. surface of primary peduncles	smooth, 0; prominently scabrellate, 10
23. number of secondary peduncles	actual number (ave.)
24. length of secondary peduncles (mm)	actual number (ave.)
25. shape of primary heads	cylindrical, 0; globose, 5; hemispherical, 10
26. width of primary heads (mm)	actual number (ave.)
27. number of spikelets/primary head	actual number (ave.)
28. number of spikelets/secondary head	actual number (ave.)
29. length of bracteoles (mm)	actual number (ave.)
30. number of veins per bracteole	actual number (ave.)
*31. length of prophyll of spikelet (mm)	actual number (ave.)
32. number of veins per prophyll	actual number (ave.)
33. shape of spikelet	oblong, 0; broadly ovate, 10
*34. length of spikelet (mm)	actual number (ave.)
*35. width of spikelet (mm)	actual number (ave.)
*36. number of scales per spikelet	actual number (ave.)
37. width of rachilla (mm)	actual number (ave.)
38. thickness of the rachilla (mm)	actual number (ave.)
39. distance between scale scars (mm)	actual number (ave.)
*40. scale angles	actual number (ave.)
*41. length of scale (mm)	actual number (ave.)
42. width of scale (mm)	actual number (ave.)
43. width of scale in lateral view (mm)	actual number (ave.)
*44. prominence of keels at base of the scale	weak, 0; prominent or distinct, 10
45. length of proximal groove on scale (mm)	actual number (ave.)
46. shape of scale apex	mucronate, 0; acute, 3; obtuse, 7; round, 10
47. curvature of scale apex	incurved, 0; straight, 5; excurved, 10
48. texture of medial part of scale	firmly membranous, 0; subcartilaginous, 10
49. surface of scales distally	smooth, 0; prominently scabrellate, 10
50. texture of sides of scale	membranous, 0; chartaceous, 10
51. color of sides of scale	stramineous, 0; brown, 5; reddish black, 10
52. nature of scale margins	not revolute, 0; revolute, 10
53. portion of sides of scale attached to rachilla (mm)	actual number (ave.)
*54. number of stamens	actual number
55. length of stamens (mm)	actual number (ave.)
*56. length of anthers (mm)	actual number (ave.)

Table 2 (Continued).

CHARACTER	CHARACTER STATE
57. pollen diameters (μ)	actual number (ave.)
58. length of style (mm)	actual number (ave.)
59. length of style branches (mm)	actual number (ave.)
*60. portion of scale that achene fills	actual number (ave.)
*61. symmetry of achene	asymmetric, 0; bilateral, 5; radial, 10
62. color of achene	stramineous, 0; brown, 5; black, 10
63. angles on the achene	acute, 0; obtuse, 10
*64. ratio of achene length to width	actual number (ave.)
65. total length of achene (mm)	actual number (ave.)
*66. nature of achene base	spongy, 0; stipitate, 10
67. length of body of achenes (mm)	actual number (ave.)
68. length of achene beak (mm)	actual number (ave.)
69. relational width of surfaces of achene	unequal, 0; equal, 10
70. width of achene adaxially (mm)	actual number (ave.)
71. width of achene abaxially (mm)	actual number (ave.)
72. shape of surfaces of achene	obovate, 0; elliptic, 5; ovate, 10
73. nature of adaxial surface of achene	convex, 0; planar, 5; concave, 10
74. nature of abaxial surfaces of achene	convex, 0; planar, 5; concave, 10
75. ease of scale and achene disarticulation	difficult, 0; easy, 10

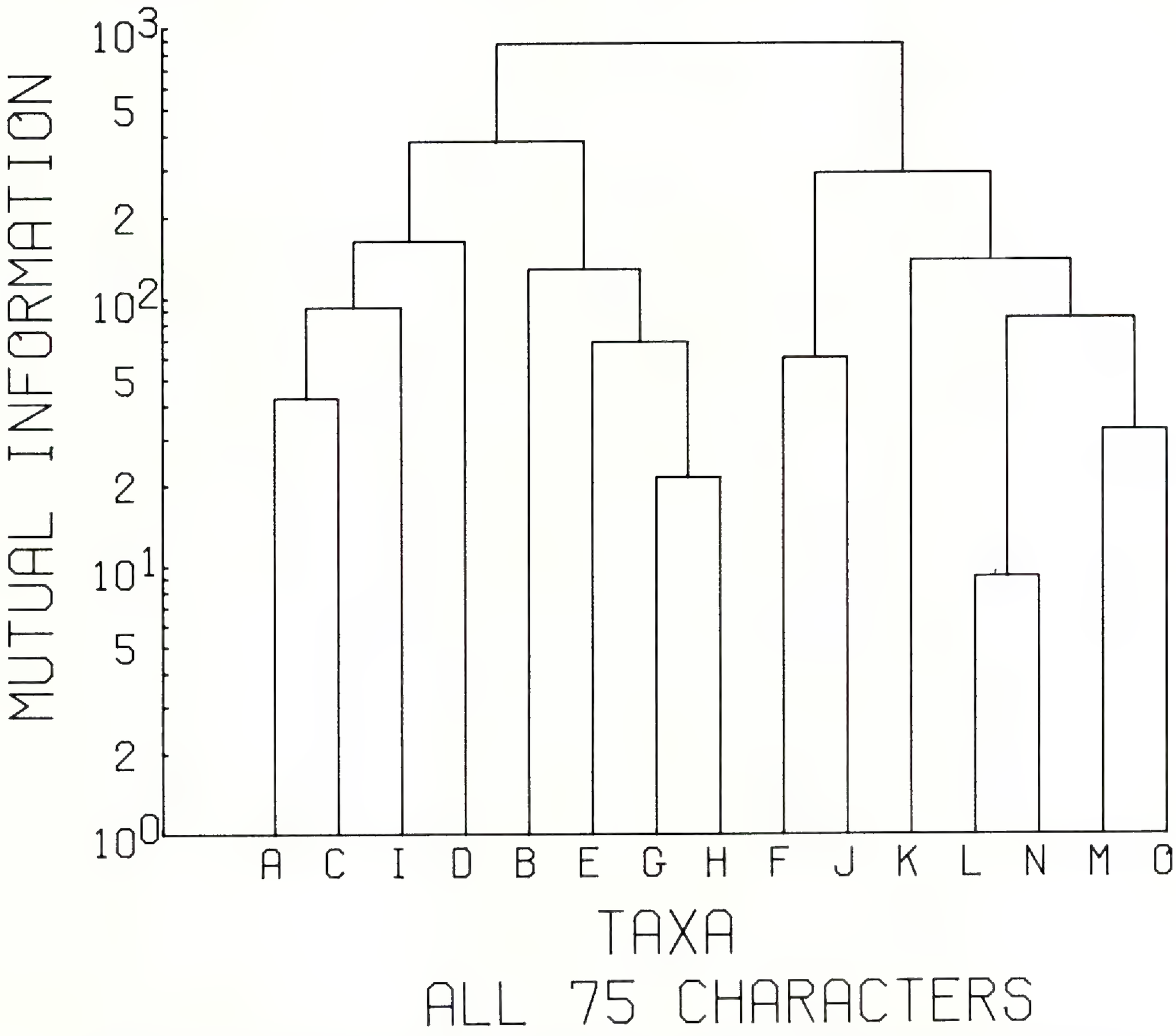

Figure 1. Dendrogram of the 15 taxa in the Luzulae group using all 75 characters. Abbreviations are as follows: A, *C. acuminatus*; B, *C. distinctus*; C, *C. eragrostis*; D, *C. intricatus*; E, *C. luzulae*; F, *C. ochraceus*; G, *C. pseudovegetus* var. *pseudovegetus*; H, *C. pseudovegetus* var. *megalanthus*; I, *C. reflexus* var. *reflexus*; J, *C. reflexus* var. *fraternus*; K, *C. surinamensis*; L, *C. virens* var. *virens*; M, *C. virens* var. *drummondii*; N, *C. virens* var. *minarum*; O, *C. virens* var. *montanus*.

Similarities in the spikelets and the scales account for the clustering of *C. reflexus* var. *reflexus, C. intricatus, C. eragrostis,* and *C. acuminatus.* All the varieties of *C. virens* are positioned near each other, and *C. surinamensis* is nearby.

In the second analysis, six vegetative and 14 reproductive characters were selected as important evolutionary ones. Here the two varieties of *C. reflexus* diverge together and are distant from the other groups; the rhizomes of these two taxa show a marked difference from the perennating structure of the other taxa. *Cyperus eragrostis* and *C. acuminatus* are grouped together, largely because of similar fruits and spikelets. Likeness in habit and in stem and leaf structure account for the clustering of *C. ochraceus* with *C. distinctus.* The four varieties of *C. virens* are located near each other, with *C. surinamensis* as a close relative. Morphologically, *C. pseudovegetus* var. *megalanthus* is intermediate between *C. pseudovegetus* var. *pseudovegetus* and *C. luzulae*; in this dendrogram (Fig. 2), however, var. *megalanthus* is positioned closer to *C. luzulae* than it is to var. *pseudovegetus.*

An analysis of the 17 vegetative characters (Fig. 3) shows a close resemblance to the results provided by the evolutionary characters (Fig. 2). The scabrous nature of the stems and their triquetrous condition probably account for the juxtaposition of *C. surinamensis* and of *C. intricatus* with the varieties of *C. virens.* The two varieties of *C. reflexus* are together but are distant from the other taxa.

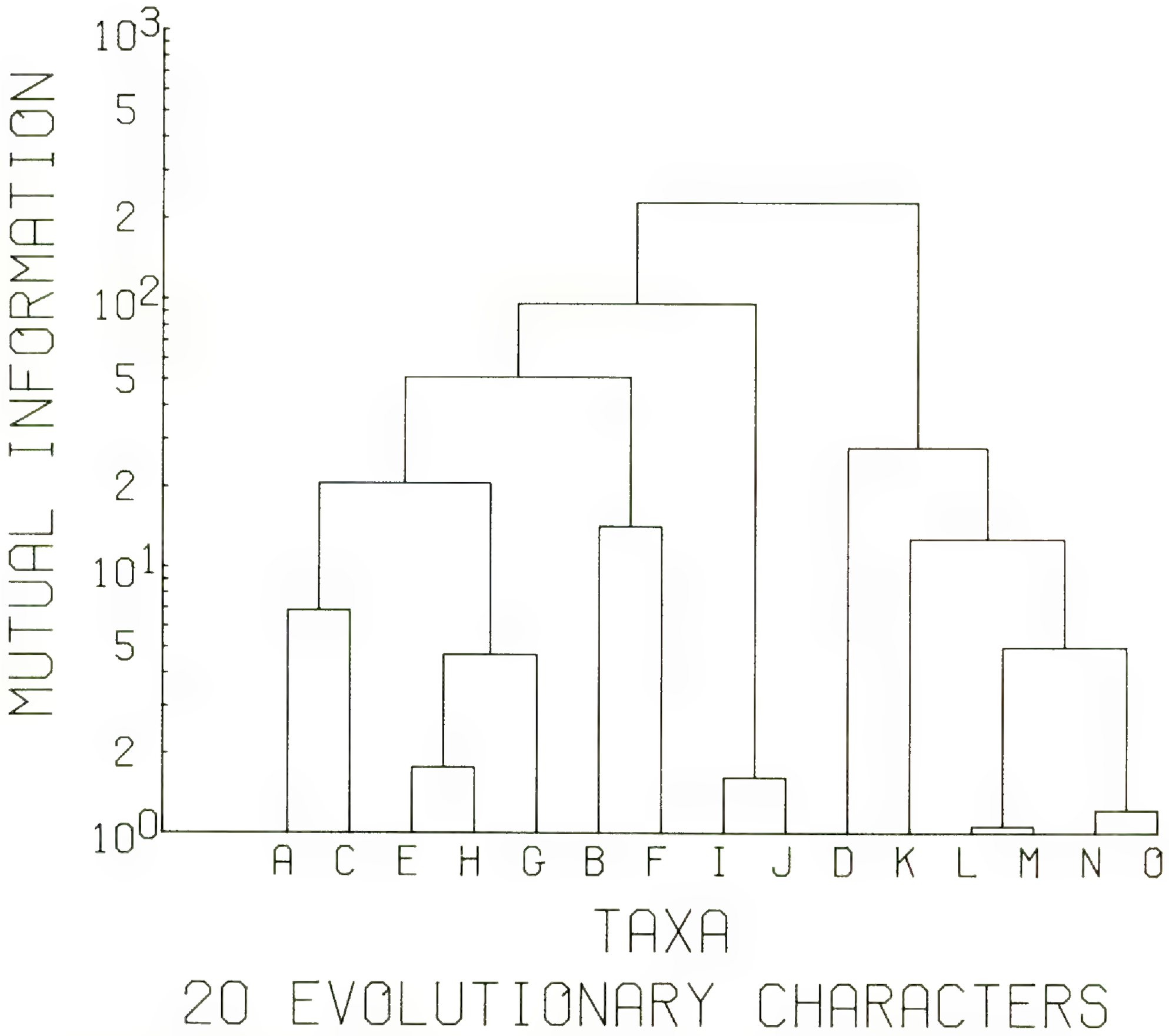

Figure 2. Dendrogram of the 15 taxa in the Luzulae group using 20 evolutionary characters. The abbreviations are the same as in Figure 1.

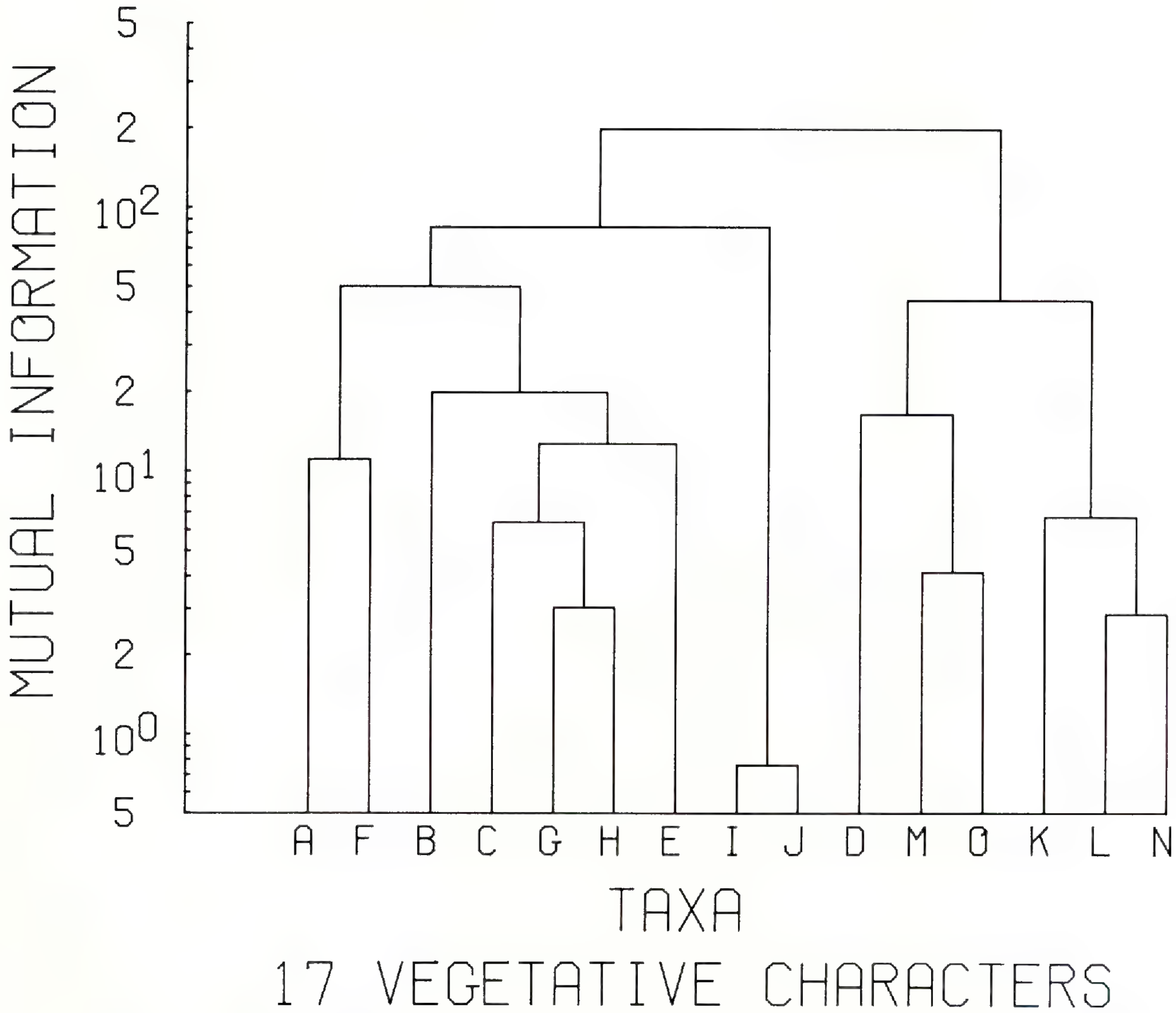

Figure 3. Dendrogram of the 15 taxa in the Luzulae group using 17 vegetative characters. The abbreviations are the same as in Figure 1.

Features of the achenes influenced the results of the dendrogram produced by an analysis of the 58 reproductive characters (Fig. 4). *Cyperus acuminatus, C. reflexus* var. *reflexus, C. eragrostis,* and *C. virens* var. *montanus* are all placed near each other because all have achenes that are approximately 2–2.5 times longer than wide. Likewise, *C. reflexus* var. *fraternus* is placed in a group which also includes *C. virens* var. *drummondii, C. virens* var. *minarum, C. virens* var. *virens, C. surinamensis,* and *C. ochraceus.* This dendrogram is the least useful in the assessment of the relationships of the taxa.

The results of the four analyses are shown by the dendrograms (Figs. 1–4) and by the rank order of characters used in the analyses (Table 3). In all four analyses, only four to seven characters were utilized to differentiate the taxa. Although some variation was expected because different sets of characters were employed in each, there were some consistencies.

The following relationships were affirmed by the study: *C. eragrostis* and *C. acuminatus* are closer to each other than to any of the other taxa; *C. luzulae* is closely related to *C. pseudovegetus,* especially to *C. pseudovegetus* var. *megalanthus; C. ochraceus* and *C. distinctus* show a close affinity to each other; and *C. surinamensis* and *C. intricatus* are related to the four varieties of *C. virens,* but together, these six taxa are distantly related to the rest of the taxa. Although reproductive characters are useful in identifying the taxa, these features may not be as important as vegetative

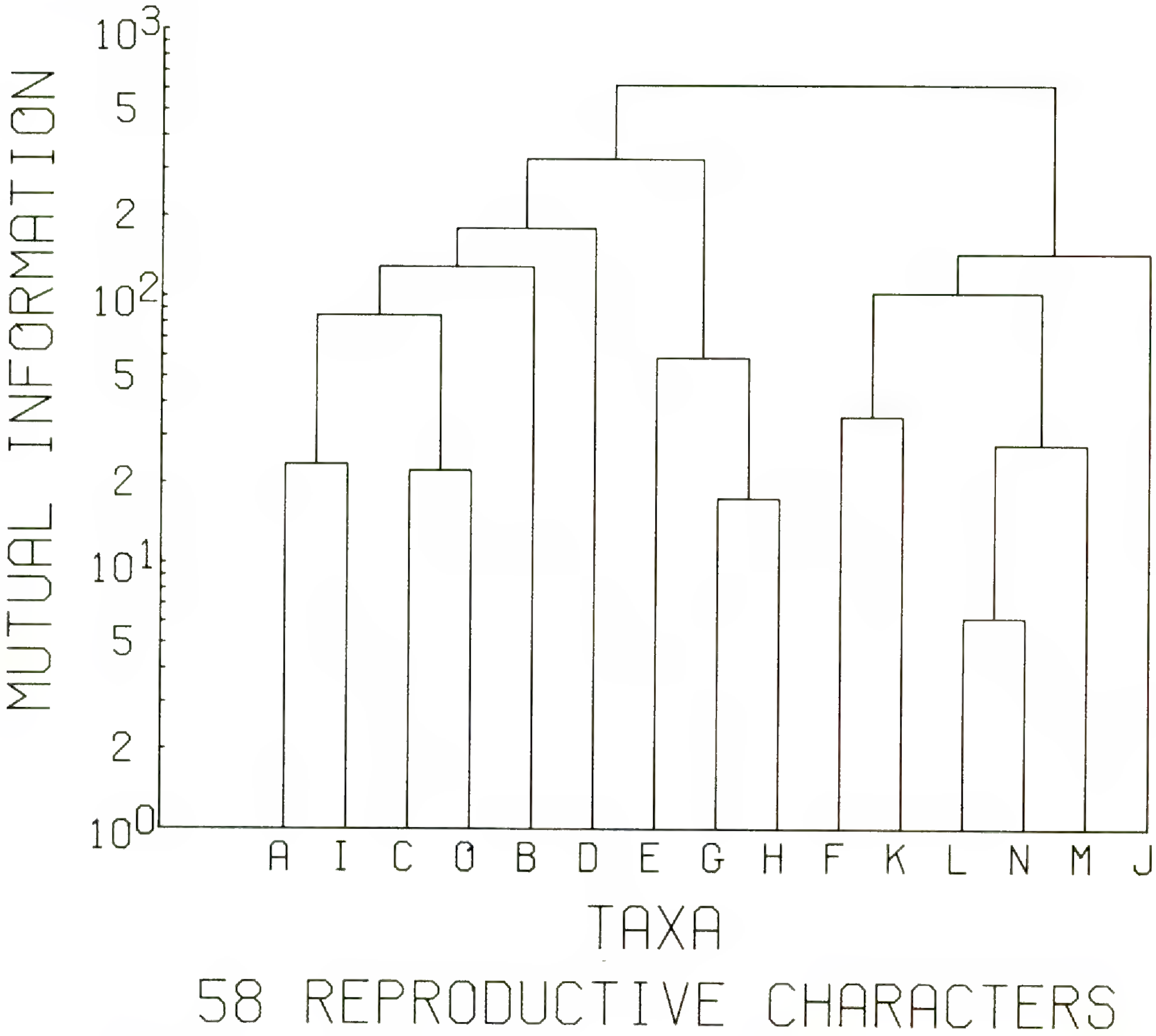

Figure 4. Dendrogram of the 15 taxa in the Luzulae group using 58 reproductive characters. The abbreviations are the same as in Figure 1.

Table 3. Rank order of characters (identified by number) used in discrimination analysis with an associated Wilks Lambda measure in parenthesis.

CLASSIFICATION BASIS			
All 75 Characters	20 Evolutionary Characters	17 Vegetative Characters	58 Reproductive Characters
4 (.01276)	22 (.00981)	13 (.03145)	63 (.11765)
33 (.00094)	13 (.00041)	4 (.00354)	75 (.01364)
44 (.00025)	3 (.00009)	17 (.00112)	33 (.00347)
1 (.00004)	1 (.00003)	10 (.00028)	25 (.00106)
5 (.00000)	31 (.00000)	5 (.00008)	31 (.00037)
17	34	7 (.00002)	49 (.00004)
7	10	3 (.00000)	48 (.00000)
26	41	12	32
45	64	14	46
64	40	11	42
55	61	8	51

ones in determining evolutionary clades. When all 75 characters were used, only five characters were selected to distinguish the taxa, and three of these were vegetative ones. Likewise, when only 20 characters were selected as evolutionary ones, five characters were discriminators in the analysis, and again, three of these were vegetative ones. The affinities of the taxa shown in Figure 2 appear to be the most reasonable in terms of morphological trends within the Luzulae group. Some of these trends are summarized in Table 4.

Table 4. Characters that are assumed to be "generalized" and "specialized" with regard to the evolution of the Luzulae group of *Cyperus*.

GENERALIZED	SPECIALIZED
1. Compound inflorescence with primary peduncles	1. Compound inflorescence with primary, secondary, and tertiary peduncles or sessile
2. Spikelets up to 16 mm long, with up to 40 scales	2. Spikelets 20–35 mm long, with up to 88 scales
3. Scales declined 30° to 60° from rachilla	3. Scales declined 60° to 90° from rachilla
4. Three stamens	4. One stamen
5. Small achenes, 0.6–0.8 mm long	5. Large achenes, 1.1–1.4 mm long
6. Stipitate base of achene	6. Swollen spongy and torulose base of achene
7. Ready disarticulation of achenes and scales	7. Tardy disarticulation of achenes and scales
8. Stems roundly triquetrous	8. Stems sharply triquetrous, winged on the angles
9. Plants perennial	9. Plants annual
10. Tropical distribution	10. Temperate distribution

THE LUZULAE GROUP OF CYPERUS

Tufted or rhizomatous herbs with fibrous roots, usually perennials, less commonly annuals; stem solid when young but becoming hollow when the central ground tissue degenerates, mostly erect, rigid, stiff or slightly flexuous, triquetrous to round, often sulcate, smooth or less commonly scabrellate or scabrous, thicker at the base than just below the compound inflorescence; foliage leaves three-ranked, elongate, strap-shaped, arising near the base of the stem, one-half as long to as long as the stem, grayish green, light to dark green or stramineous; leaf sheath generally less than one-third the total length of the leaf, not distinctly differentiated from the blade, sometimes with transverse septa between the veins, occasionally nodulose, often with red unicellular glands adaxially, closed but eventually rupturing in the membranous region opposite the blade and opening to the base, the torn margins erose and easily sloughed off; leaf blade dorsiventral, flat or conduplicate, wiry, coriaceous or sometimes thin and flexuous, the margins antrorsely scabrous (especially on young leaves), the apex acute to attenuate; involucral bracts two to several, spirally arranged, sheathless or with an inconspicuous sheath less than 4 mm long, dorsiventral, flat or conduplicate, elongate, unequal in length with the longer ones surpassing the inflorescence, usually shorter and narrower than the foliage leaves, grayish green, light to dark green or stramineous, sometimes with transverse septa between the veins, occasionally nodulose, the margins often scabrous, apically acute to attenuate; foliage leaves and involucral bracts with epidermal cells often longer and wider on adaxial surfaces than on the abaxial, and with stomates on abaxial (rarely adaxial) surfaces; bracteoles narrowly to broadly ovate, up to 3 mm long, chartaceous or membranous, light green or stramineous, with (three–) five to several reddish veins, the margins entire to scabrellate distally, the midrib minutely scabrellate to scabrous near the acute, attenuate, cuspidate or caudate apex; prophyll of primary or secondary peduncle basally tubular, rounded or truncate distally, up to 16 mm long, membranous to chartaceous, with five to many veins; prophyll of spikelet tubular, rounded to truncate distally, up to 1 mm long, membranous to chartaceous, hyaline, the veins absent or up to seven; compound inflorescence superficially capitate or umbelliform, with closely imbricate spikelets aggregated to form spherical, hemispherical, pyramidal, or cylindrical heads, these sessile or pedunculate; primary peduncles, if present, several, of unequal length, up to 16 cm long, 0.5–1.5 mm wide, triquetrous to round, erect to spreading, rigid to stiff to flexuous, usually sulcate, glabrous or minutely scabrellate; secondary peduncles arising from the terminal part of the primary ones, of unequal length but shorter than the primary ones, up to 3 cm long, 0.4–1 mm wide, triquetrous to round, stiff to flexuous, usually sulcate, glabrous or minutely scabrellate, supporting heads with fewer spikelets than those of the primary peduncles; spikelets spirally arranged within compact heads, laterally compressed, ovate, oblong, or linear, 1.5–16 (–35) mm long, 0.8–4 mm wide, with (4–) 10–40 (–88) distichous scales maturing and subsequently deciduous acropetally as fruits ripen; rachilla tetraquetrous, nearly as long as the spikelet, 0.15–0.50 mm wide, up to 0.2 mm thick, typically wingless, cartilaginous, straight or arched, persistent, stramineous with a few reddish striations or totally light to dark reddish black, bearing prominently elevated transverse scale scars, these 0.5–0.8 mm apart on each side; scale angles 30°–60° (–90°); scales boat-shaped, broadly to narrowly ovate, 1–3 mm long, 0.5–2 mm wide, 3-veined, attached basally by the portion between the keels and part or all of the sides, apically rounded, obtuse,

acute, mucronate or cuspidate, distinctly or weakly bicarinate proximally but the two keels merging on the distal one-half to form a single centralized keel, the proximal abaxial groove between the keels 0.8–1.8 mm long and as wide as the rachilla; medial part of scale usually prominently elevated, thicker than and distinct from the sides and partially visible in lateral view, subcartilaginous or firmly membranous, smooth or scabrellate on the single distal keel, pale green, stramineous, or sometimes golden brown to reddish brown; sides of scale widest just below the middle and generally narrowing toward the base, membranous, chartaceous or crustaceous, reticulate or smooth, translucent or opaque or shiny, light green or yellowish when young but ripening to pale yellow, brown, golden brown, red, reddish brown, or reddish black, the margins straight or partially to completely revolute and clasping the achene; flower solitary in scale axil, bisexual, lacking a perianth; stamens one or two, arising abaxially from the stipitate or spongy base of the ovary; filaments ribbonlike, often hyaline, amber or dull white; anthers basifixed, bilocular, linear, two to five times longer than wide, yellow, with longitudinal dehiscence; pollen spherical, 20–30 μ in diameter, of nearly uniform size for all the included taxa, trinucleate; gynoecium tricarpellate; ovary superior, obtusely to acutely trigonous, unilocular, with basal placentation of the single, erect, anatropous ovule; style trifid, the stigmatic branches light to dark brown, deciduous; achene filling two-fifths to all of the scale, radially or bilaterally symmetric or sometimes asymmetric, narrowly to broadly trigonous, two to seven times longer than wide, 0.8–1.5 mm long, 0.2–0.6 mm wide, brown or black, conspicuously or barely stipitate or with a basal white to brown spongy and torulose parenchymatous tissue 0.2 mm long and as wide as the achene, apically narrowed to a slender beak continuous with the style and 0.1–0.5 mm long; achenial surfaces usually puncticulate, of equal or slightly differing width, elliptic, ovate or obovate, planar or slightly concave (seldom convex), often covered with a tardily deciduous single layer of translucent or often iridescent cells; embryo embedded in abundant endosperm.

DIRECTIONS FOR USE OF KEY

1) The *height of the plant* is measured from the base of the stem to the base of the involucral bracts.
2) The *proportion of the scale filled by the achene* should be measured or estimated while the achene is still enclosed by the scale.
3) The *width of the scale in lateral view* can be observed by noting the lateral compression of the spikelet; part of the subcartilaginous middle part of the scale will be evident as well as the membranous or crustaceous side of the scale.
4) The *proximal abaxial groove* of the scale is located between the two basal keels and extends toward the apex; the length of the groove can usually be measured while the scale is still attached to the rachilla.
5) The *scale angle* is the angle of declension of the scale from the rachilla.
6) *Measurements* of scales, stamens, and achenes should be made near the base of the spikelet where these structures are most likely to be mature.

KEY TO THE LUZULAE GROUP OF CYPERUS

1. Achenes with conspicuous white to light brown spongy and torulosic bases ca 0.2 mm long and as wide as the rest of the achenes; stems glabrous; North America. *C. distinctus.*
1. Achenes with or without prominent stipitate bases, lacking enlarged spongy tissues at the bases; stems glabrous to scabrous; North and South America.
   2. Stems scabrous to scabrellate at least below the involucral bracts, either generally over the surface or just on the angles.

3. Stems round to triquetrous, scabrellate generally over the surface (not just on the angles); leaf blades and involucral bracts smooth or with inconspicuous and sparse septa between the veins, weakly nodulose; stamen solitary; annuals or delicate perennials, usually less than 60 cm tall.
   4. Achenes narrowly trigonous, ca three times longer than wide; scales 1–1.5 mm long, the sides translucent, membranous and usually pale yellow or light brown (rarely reddish brown), the apices straight (or subtly excurved); tufted perennials; North and South America. *C. surinamensis.*
   4. Achenes broadly trigonous, 2–2.5 times longer than wide; scales (1.2–) 1.5–2 mm long, the sides opaque (or shiny), usually papyraceous, and yellow, brown, or reddish brown, the apices usually excurved; tufted annuals, rarely perennials; North America. *C. acuminatus.*
3. Stems triquetrous and scabrous on the acute and often winged angles; leaf blades and involucral bracts usually with conspicuous septa between the veins, nodulose; stamens one or two; sturdy perennials often more than 60 cm tall.
   5. Scales 2–3 mm long, straight or inwardly arched, the sides red, reddish black, reddish brown, or light brown.
      6. Spikelets 4–6 mm long, 3.5–4 mm wide; scales 2–3 mm long, 0.5–0.8 mm wide in lateral view, the sides dark red, dark reddish black, or brown; primary peduncles up to 8 cm long; South America. *C. intricatus.*
      6. Spikelets (5–) 7–15 mm long, 2–3.3 mm wide; scales 2–2.4 mm long, 0.4–0.6 mm wide in lateral view, the sides brown; primary peduncles up to 14 cm long; North and South America. *C. virens* var. *virens.*
   5. Scales 1–2 mm long, straight, the sides brown to light reddish brown.
      7. Scales 1–1.5 (–1.8) mm long; spikelets 1.5–2.2 (–2.5) mm wide; primary peduncles 2–5 (–6), usually up to 2 (–4) cm long; leaf blades 3–5 (–7) mm wide at mid-length; achenes filling seven-eighths of the scales. *C. virens* var. *drummondii.*
      7. Scales 1.5–2 mm long; spikelets (2–) 2.2–3.3 mm wide; primary peduncles 6–15, up to 12 cm long; leaf blades (4–) 7–14 mm wide at mid-length; achenes filling one-half to three-fourths of the scales.
         8. Achenes (1–) 1.2–1.5 mm long, (2.5–) 3–5 times longer than wide, obtusely angled, the surfaces usually planar or sometimes concave; spikelets (5–) 7–15 mm long. *C. virens* var. *virens.*
         8. Achenes 1–1.2 mm long, 2–2.5 times longer than wide, acutely or obtusely angled, the surfaces (or at least the two abaxial ones) concave; spikelets 5–10 mm long.
            9. Spikelets 7–10 mm long, 3–3.6 mm wide; achenes filling one-half to two-thirds of the scales, acutely angled, slightly concave on the adaxial surface; scales 0.3–0.5 (–0.8) mm wide in lateral view, generally brown; primary peduncles up to 10 cm long; secondary peduncles up to 4 cm long; tertiary peduncles up to 1 cm long; involucral bracts up to 12 mm wide; South America. *C. virens* var. *montanus.*
            9. Spikelets 5–6.5 mm long, 2.2–2.5 mm wide; achenes filling two-thirds or more of the scales, obtusely angled, usually planar on the adaxial surface; scales 0.5 (–0.8) mm wide in lateral view, generally reddish brown; primary peduncles up to 7 cm long; secondary peduncles, when present, up to 2 cm long; tertiary peduncles absent; involucral bracts up to 5 mm wide; North and South America. *C. virens* var. *minarum.*
2. Stems smooth.
   10. Involucral bracts with the primary and longest bract wiry, ± erect (sometimes reflexed by a nearly sessile and large head), and appearing like a prolongation of the stem, up to 3 mm wide; scales 1–2 (–2.2) mm long; stamen solitary; scaly rhizomes usually evident.
      11. Achenes 2–2.5 times longer than wide; scales usually falcate in lateral view, the sides reticulate when mature, the apices usually excurved (seldom straight); tufted annuals or short-lived perennials; North America. *C. acuminatus.*
      11. Achenes 2.5–3 times longer than wide; scales ± triangular in lateral view, the sides typically smooth and glossy when mature, the apices straight or slightly excurved; rhizomatous perennials; North and South America. *C. reflexus.*
         12. Achenes filling two-fifths to three-fifths of the scales, broadly trigonous, usually 2.5 times longer than wide, the surfaces generally concave; scales (1–) 1.5–1.8 (–2.1) mm long, the sides red and shiny. *C. reflexus* var. *reflexus.*

12. Achenes filling three-fifths to three-fourths of the scales, narrowly trigonous, usually three times longer than wide, the surfaces planar (only slightly if at all concave); scales 1.5–2 mm long, the sides usually light brown and either shiny or dull. *C. reflexus* var. *fraternus.*

10. Involucral bracts typically foliaceous, spreading to reflexed, (1–) 3–12 mm wide; scales 1–3 mm long; stamens one or two; scaly rhizomes absent or short.
13. Achenes broadly trigonous, 2–2.5 times longer than wide.
14. Annuals up to 30 (–46) cm tall; spikelets 4–7 mm long; scales (1.2–) 2 mm long, the apices usually excurved (seldom straight); rachillas 0.15–0.2 mm wide; achenes 0.8–1.1 mm long, the surfaces 0.3–0.4 mm wide; North America. *C. acuminatus.*

14. Perennials up to 90 cm tall; spikelets 4–20 (–35) mm long; scales 1.5–3 mm long, the apices straight or incurved (rarely excurved); rachillas 0.3–0.5 mm wide; achenes 1–1.5 mm long, the surfaces 0.4–0.6 mm wide; North and South America.
15. Scale angles (45°–) 60°–90° for mature scales; scales (1.2–) 1.5–2 mm long, the proximal abaxial grooves 0.6–1.5 mm long, the apices incurved or straight; achenes obtusely angled, filling two-thirds to three-fourths of the scales, the surfaces convex or planar; involucral bracts 2–6 mm wide. *C. ochraceus.*

15. Scale angles 30°–45° for mature scales; scales (1.5–) 2–3 mm long, the proximal abaxial grooves 0.3–0.6 (–0.8) mm long, the apices straight (rarely excurved); achenes acutely angled, filling two-fifths to three-fifths of the scales, the surfaces slightly concave; involucral bracts 1.5–12 mm wide.
16. Scales 1.5–2 (–2.4) mm long, the margins brown; secondary peduncles up to 4 cm long; stems acutely triquetrous; refer to varieties under leads 5–9. *C. virens.*

16. Scales 2–3 mm long, the margins reddish brown, reddish black, dark red or brown; secondary peduncles up to 2 (rarely to 3) cm long; stems round to triquetrous.
17. Spikelets 5–20 mm long; scales 2–2.3 mm long, 0.3–0.6 mm wide in lateral view, smooth or minutely scabrellate distally, the sides brown to golden brown; achenes ca two times longer than wide; stamen solitary; North and South America. *C. eragrostis.*
17. Spikelets 4–6 mm long; scales 2–3 mm long, 0.5–0.8 mm wide in lateral view, prominently scabrellate distally (rarely smooth), the sides red, reddish black, reddish brown, or light brown; achenes 2.5–4 times longer than wide; stamens (one or) two; South America. *C. intricatus.*

13. Achenes narrowly trigonous, (2.5–) 3–7 times longer than wide.
18. Scales 1–1.5 (–2) mm long; achenes 0.8–1 (–1.2) mm long.
19. Sides of scales translucent and either pale yellow or light brown (seldom reddish brown); scales 1–1.5 mm long, the apices acute and straight (or subtly excurved); spikelets with (10–) 20–58 (–72) scales. *C. surinamensis.*
19. Sides of scales opaque (or shiny), and dull white, stramineous, golden brown, or reddish brown; scales 1–2 mm long, the apices rounded to acute and either incurved or straight or excurved; spikelets with (4–) 6–40 scales.
20. Scales 1–1.5 (–2) mm long, the sides dull white, stramineous or light brown, the apices rounded to acute and either incurved or straight; spikelets 0.8–2.2 mm wide; involucral bracts 7–12, up to 70 cm long; leaf blades 5–12 mm wide; achenes 0.9–1 (–1.2) mm long. *C. luzulae.*

20. Scales 1.5–2 mm long, the sides yellowish brown or reddish brown, the apices acute to cuspidate and slightly excurved (sometimes straight); spikelets 1.5–3 mm wide; involucral bracts 3–8, up to 50 cm long; leaf blades (1–) 4–6 (–8) mm wide; achenes 1–1.3 (–1.5) mm long.
21. Scale angles ca 45° for mature scales; stems acutely triquetrous; scales 0.4–0.6 mm wide in lateral view, the apices straight; achenes 2–5 times longer than wide, the surfaces often unequal in width; stamens one or two; refer to varieties under leads 5–9. *C. virens.*
21. Scale angles 20°–30° (–45°) for mature scales; stems round to roundly triquetrous; scales 0.2–0.3 mm wide in lateral view, the apices slightly excurved; achenes 5–7 times longer than wide, the surfaces ± equal in width; stamen solitary. *C. pseudovegetus* var. *pseudovegetus.*

18. Scales 2–3 mm long; achenes 1–1.5 mm long.

22. Scales 2–3 mm long, 0.5–0.8 mm wide in lateral view, prominently scabrellate distally (rarely smooth), the apices straight; stamens (one or) two; achenes 2.5–4 times longer than wide; South America. *C. intricatus.*
22. Scales 2–2.5 mm long, 0.2–0.3 mm wide in lateral view, barely scabrellate distally, the apices usually excurved; stamen solitary; achenes 4–7 times longer than wide; North America. *C. pseudovegetus.*
23. Involucral bracts 4–8, up to 4 mm wide; spikelets 1.5–3 mm wide; scales 1.5–2.2 mm long, the proximal abaxial groove 0.8–1 mm long; scale angles 20°–30° (–45°); achenes filling ca three-fourths of the scales. *C. pseudovegetus* var. *pseudovegetus.*
23. Involucral bracts (5–) 8–18 (–40), up to 9 mm wide; spikelets 3–4 mm wide; scales 2–2.5 mm long, the proximal abaxial groove 1.2–1.5 mm long; scale angles 30°–45°; achenes filling ca one-half of the scales. *C. pseudovegetus* var. *megalanthus.*

Cyperus acuminatus Torrey & Hooker, Ann. Lyceum Nat. Hist. New York 3: 435. 1836. Type: United States, Missouri, St. Louis, *Drummond s.n.* (K!, lectotype; NY!, isolectotype). Figure 5 (E–H).

Cyperus cyrtolepis Torrey & Hooker, Ann. Lyceum Nat. Hist. New York 3: 436. 1836. Type: United States, Texas, Rio Brazos, 1835, *Drummond 450* (NY!, lectotype; B!, K!, isolectotypes).

Cyperus cyrtolepis Torrey & Hooker var. *caespitosus* Böckeler, Linnaea 35: 558. 1868, *nom. illegit.* Type: *Drummond 450,* which is the type of *C. cyrtolepis.*

Cyperus rufescens Torrey & Hooker var. *denticarinatus* Britton, Bull. Torrey Bot. Club 11: 85. 1884. Type: Valley of the Rio Grande, in Texas and northern Mexico, 1879–1883, *S. B. Buckley s.n.* (NY!, holotype).

Cyperus cyrtolepis Torrey & Hooker var. *denticarinatus* (Britton) Britton, Bull. Torrey Bot. Club 13: 209. 1886.

Cyperus acuminatus Torrey & Hooker var. *cyrtolepis* (Torrey & Hooker) Kükenthal, Pflanzenreich IV. 20 (Heft 101): 178. 1936.

Tufted annual or sometimes short-lived perennial, up to 30 (–46) cm tall; stems mostly erect, somewhat flexuous, roundly triquetrous, usually smooth or seldom scabrellate on the upper one-half, grayish green or stramineous, 0.4–1 mm wide distally, 0.7–1.2 mm wide at the base; leaves 2–8, one-half as long as the stem, 8–17 (–35) cm long; leaf sheath 2–12 cm long, light green to light brown, rarely reddish brown, with sparse transverse septa between the veins, occasionally persistent and becoming darker brown and partially fibrous the second year; leaf blade 1–2.5 (–4.5) mm wide at mid-length, flat or conduplicate, grayish green or stramineous, acute at apex; involucral bracts 3–6, usually foliaceous and spreading but sometimes the lowermost and longest bract wiry, stiff, ± erect, and appearing like a prolongation of the stem, up to 31 cm long, up to 3.8 mm wide, sheathless, flat or conduplicate, grayish green or stramineous, lacking transverse septa between the veins, apically acute; compound inflorescence 2–8 cm long; primary peduncles 1–3 (–5), up to 2 cm long; 0.5–1 mm wide, roundly triquetrous, smooth, slightly flexuous; secondary peduncles absent or 1–3, up to 2 cm long, ca 0.5 mm wide, straight or slightly flexuous; heads hemispherical, the primary ones 7–17 mm wide and with (12–) 20–75 spikelets, the secondary ones 7–12 mm wide and with (8–) 20–40 spikelets; bracteoles narrowly ovate, 2.5–5 mm long, 3–5-veined, chartaceous, apically cuspidate to caudate; prophyll of spikelet 0.5–1 mm long, membranous and hyaline, the veins 3 or absent; spikelets ovate, 4–7 mm long, 2–3 mm wide, apically acute, with 8–26 (–42) scales; rachilla 0.15–0.2 mm wide, ca 0.5 mm thick, straight, adaxially stramineous or with a few red to reddish-brown glandular longitudinal striations, the transverse scale scars 0.5–0.6 mm apart on each side; scale angles 30°–45°; scales (1–) 1.3–2 mm long, 1–1.2 (–1.5) mm wide, or 0.4–0.5 mm wide and falcate in lateral view, usually with a few yellow or red glands adaxially, apically acute to cuspidate and usually excurved, seldom straight, distinctly bicarinate basally, the proximal abaxial groove between the

Figure 5. A–D. *Cyperus ochraceus* (based on *Dieterle 4256*); A, inflorescence, × ½; B, spikelet, × 5; C, scale, × 17.5; D, achene, × 17.5. E–H. *Cyperus acuminatus* (based on *Eggert 351*); E, inflorescence, × ½; F, spikelet, × 5; G, scale, × 17.5; H, achene, × 17.5. I–L. *Cyperus eragrostis* (based on *Bartlett 19266*); I, inflorescence, × ½; J, spikelet, × 5; K, scale, × 17.5; L, achene, × 17.5.

two keels 0.3–0.4 mm long; medial part of scale firmly membranous or subcartilaginous, green or light brown, barely scabrellate distally; sides of scale membranous to chartaceous and reticulate with conspicuous cells, light green, yellow, brown or light reddish brown, the margins revolute on the lower two-fifths especially where the scale narrows and encloses the achene, basally attached to the rachilla for ca 0.1 mm, leaving at least 0.1 mm free on each side; stamen solitary, 1.5–2 mm long, the filament 1–1.5 mm long, the anther 0.5 (–0.7) mm long; pollen 25–30 μ in diameter; style ca 1 mm long, the stigmatic branches ca 0.5 mm long; achene filling two-fifths to three-fifths of the scale, radially or slightly bilaterally symmetric, brown, broadly trigonous, acutely angled, two to two and one-half times longer than wide, 0.7–1.1 mm long (total length), the stipitate base less than 0.1 mm long, the body 0.5–0.9 mm long, and the slender apical beak 0.1–0.2 mm long; achenial surfaces of equal width, 0.3–0.4 mm wide, slightly obovate or elliptic, usually planar (seldom convex) adaxially, scarcely concave abaxially.

Distribution. Virginia south to Alabama and west to North Dakota, Colorado and Texas, and in Washington, Oregon, and California; in Mexico, only from Coahuila. Found in open pastures, swales, low moist depressions, moist sandy ditches, or salt flats in clayey, loam or limestone soils at elevations usually up to 430 meters, but as high as 2000 meters in Mexico (Fig. 6).

Discussion. Typically an annual with a shallow, fibrous root system, this species may persist as a perennial for two or more years in the southern limit of its distribution. The stems are characteristically triquetrous and glabrous, but a few specimens (mostly from Texas, and a few isolated collections from Nebraska and Minnesota) have stems that are scabrellate distally.

The scales and achenes are the basic features for distinguishing this taxon. The scales are generally membranous, with conspicuous reticulate cells and with strongly

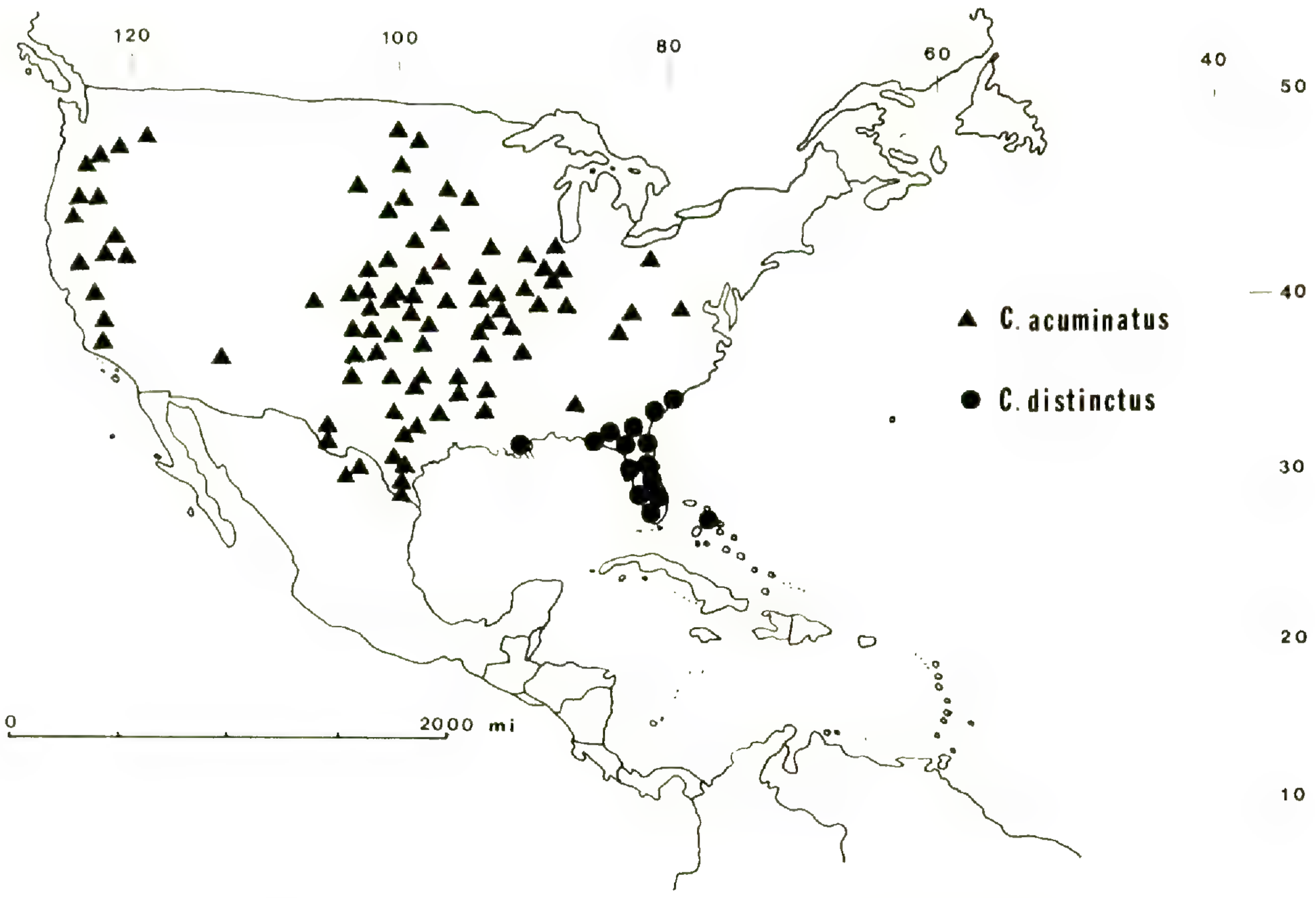

Figure 6. Distribution of *Cyperus acuminatus* and *C. distinctus.*

excurved apices. As the scales mature, the texture becomes firmer, the apices arch outwardly, and the color may intensify as light green, yellow, brown, or light reddish brown. The length of the scale may vary by 0.5 mm on a single individual or by 1 mm for the species as a whole. Mostly, the scales are 1.5–2 mm long and falcate in lateral view; exceptions may be found on specimens from Cameron County, Texas, where the scales are 1–1.5 mm long and tend to be triangular in lateral view, the apices scarcely (if at all) excurved. The broadly trigonous achenes are two to two and one-half times longer than wide and consistently fill two-fifths to three-fifths of the scales.

Cyperus acuminatus has sometimes been confused with *C. reflexus* var. *reflexus* and with *C. surinamensis* because of similarities in size and habit, but all of these taxa differ with respect to features of the scales and achenes. All three occur in Texas, and *C. acuminatus* and *C. surinamensis* overlap in geographic distribution throughout much of the southeastern United States.

Hybridization between *C. acuminatus* and *C. surinamensis* or *C. reflexus* may create some of the morphologically intermediate plants that exist in Texas, but this still needs to be documented. Some of the variants suggest *C. acuminatus* except for the scabrellate stems that are typical for *C. surinamensis,* while others have scales that are similar in texture and shape to *C. acuminatus* but similar in color pattern to *C. reflexus*; these variants and their putative parents have broadly trigonous achenes (as in *C. acuminatus* and *C. reflexus* var. *reflexus*) and may have the lowermost involucral bract stiff, erect, and elongate. One of the intermediate collections serves as the type of *C. rufescens* var. *denticarinatus,* considered here as a synonym.

Representative specimens:

UNITED STATES OF AMERICA: VIRGINIA: ROANOKE CO: ca 1.6 mi SW of Salem P. O., 11 Aug 1942, *Wood, Jr. 5017* (GH).

OHIO: ROSS CO: near Delano Station, 16 Aug 1939, *Bartley & Pontius 762* (DUKE, NY).

KENTUCKY: no locality, 1859, *Short s.n.* (UC).

TENNESSEE: RUTHERFORD CO: Lavergne, 12 Aug 1922, *Svenson 209* (GH).

ALABAMA: LIMESTONE CO: Wheeler Reservoir, 3 June 1944, *Isely 3451* (TEX).

ILLINOIS: ADAMS CO: Camp Point, Sep 1878, *Seymour s.n.* (DUKE). CHAMPAIGN CO: Urbana, 28 Sep 1909, *Pease 12487* (GH); Mayview, 6 Oct 1907, *Gates 2359* (MICH). HENDERSON CO: banks of the Mississippi near Oquawka, 21 Aug 1873, *Patterson s.n.* (CAS, GH, MICH, MO, NY, UC). JERSEY CO: Kemper, Sep 1904, *McDonald s.n.* (GH). MACON CO: Decatur, 8 June 1899, *Clokey 1080* (UC). MCDONOUGH CO: S of Bushnell, 2 Sep 1950, *Chase 11500* (UC). PEORIA CO: Sec. 10, Medina Twp., 27 Sep 1952, *Chase 13097* (DS, NY, UC). STARK CO: ditch near Wady Petra, 5 Aug 1898, *Chase 153* (LY), 18 July 1900, *Chase 682* (LY, MO).

MINNESOTA: NICOLLET CO: 3–4 mi W of Courtland, 27 Aug 1947, *Moore & Huff 19782* (GH). PIPESTONE CO: Sioux quartzite ½ mi N of Pipestone, 15 Sep 1938, *Moore & Moore 10549* (DUKE, GH, NY, TEX, UC).

IOWA: JEFFERSON CO: Collett, 1897, *Baldwin 455* (GH, MO). WOODBURY CO: Sioux City, 18_, *Hitchcock s.n.* (MO).

MISSOURI: JASPER CO: Neck, 2 Oct 1910, *Palmer 3229* (BM); Joplin, 19 June 1909, *Palmer 2264* (BM); Neck City, 16 Aug 1919, *Palmer 2784* (GH). LINN CO: 4 mi SW of Laclede, 26 June 1941, *Steyermark 40435* (GH). MCDONALD CO: Anderson, 24 July 1892, *Bush s.n.* (MO). ST. LOUIS CO: near St. Louis, no date, *Glatfelter 92* (MICH); Forest Park, 21 Sep 1875, *Eggert s.n.* (B, C, M, NY, TO); St. Louis, *Eggert 351* (MICH); St. Louis, "from type locality," Sep 1845, *Engelmann s.n.* (BM, TEX). SHANNON CO: no locality, 22 July 1891, *Bush s.n.* (MO).

ARKANSAS: CARROLL CO: Beaver, 24 July 1914, *Palmer 6365* (MO). MILLER CO: Mandeville, 10 June 1898, *Eggert s.n.* (MO). PULASKI CO: bottomlands, 4 June 1885, *Hasse s.n.* (M); Little Rock, June 1886, *Hasse s.n.* (DS). ST. FRANCIS CO: swampy regions around Black Fish Lake, 13 June 1935, *Demaree 11407* (DS, WTU). WASHINGTON CO: Fayetteville, 6 July 1915, *Palmer 8173* (CAS, MO).

LOUISIANA: CADDO PARISH: ca 3 mi NW of Keithville, 7 July 1970, *Thieret 32114* (DUKE). MOREHOUSE PARISH: 9 mi SE of Haile, 1 July 1968, *Thieret 29857* (DUKE, LL). OUACHITA PARISH: ca 7 mi SW of West Monroe, 9 June 1964, *Kral 20342* (UC).

NORTH DAKOTA: BENSON CO: Leeds, 24 Aug 1901, *Lunell s.n.* (DS, GH). CASS CO: Fargo, 14 Aug 1942, *Stevens 651* (MO, UC).

SOUTH DAKOTA: BROWN CO: Aberdeen, 25 Sep 1897, *Griffiths 859* (GH). CUSTER CO:

Black Hills, Custer, 16 July 1892, *Rydberg 1068* (K). MELLETTE CO: 4 mi E of Mellette, 9 Mar 1944, *Brenckle 4303* (B, GH, NY, TEX), 12 Aug 1943, *Brenckle 43–03* (CAS).

NEBRASKA: CHASE CO: near Enders, 9 Aug 1941, *Tolstead 4183* (UC); near Lamar, 4 Aug 1941, *Tolstead 4184* (UC). CLAY CO: 3 mi S of Clay Center, 15 Aug 1941, *Tolstead 41823* (UC); 3 mi SE of Fairfield, 5 July 1941, *Tolstead 4182* (MO.) DODGE CO: nr Waterloo, 16 July 1941, *Tolstead 4187* (DUKE, MO, UC). FILLMORE CO: Fairmont, 1 mi W, 15 Aug 1944, *Kiener 17141* (UC), *17155* (TEX); 2 mi NW of Shickley, 8 July 1941, *Tolstead 4189* (TEX). FRANKLIN CO: 6 mi N of Franklin, 14 Aug 1941, *Tolstead 4190* (UC). HALL CO: near Grand Island, 28 Aug 1943, *Kiener 15166* (GH). HAMILTON CO: near Aurora, 21 July 1941, *Tolstead 4192* (DUKE, UC). HOLT CO: 20 mi S of O'Neill, 20 Aug 1941, *Tolstead 4195* (UC). KEARNEY CO: Minden, 3 Aug 1920, *Hapeman s.n.* (DS, MICH), 24 Aug 1930, *Hapeman s.n.* (DS, MICH, TEX). KEITH CO: near Kingsley Dam, 22 Sep 1943, *Kiener 15581* (TEX). NUCKOLLS CO: nr Superior, 16 Sep 1941, *Tolstead s.n.* (UC). OTOE CO: SE of Syracuse, 23 Aug 1946, *Kiener 21452* (TEX). PERKINS CO: N of Grant, 5 Sep 1943, *Kiener 15288* (GH, TEX); 2 mi E of Grant, 2 Aug 1941, *Tolstead 4198* (MO, UC). PHELPS CO: S of Holdrege, 10 Sep 1941, *Tolstead 4199* (UC), 23 July 1941, *4199* (MO). RICHARDSON CO: swamp NW of Stella, 15 July 1940, *Reynolds 1769* (UC). SALINE CO: 2 mi S of Dorchester, 11 July 1941, *Tolstead 41101* (UC). WEBSTER CO: 10 mi NW of Red Cloud, 14 Sep 1941, *Tolstead 41102* (UC). YORK CO: York, 23 Aug 1943, *Kiener 15005* (GH).

KANSAS: COFFEY CO: about ½ mi E of Waverly, no date, *Henderson 66-670* (CAS). HARVEY CO: 4 mi N of Burrton, 19 Aug 1939, *Horr E286* (B, GH, L, TEX, UC). LANE CO: about 1 mi W of Dighton, 15 Sep 1967, *Henderson 67-1776* (CAS). WOODSON CO: ½ mi E of Yates Center, 7 July 1955, *Lathrop 1224* (UC).

OKLAHOMA: BRYAN CO: Durant, 20 Oct 1947, *Stratton 6728* (GH); Rock Creek, Lake Texoma, 28 Sep 1949, *Bonn 51-444* (TEX). CARTER CO: 5 mi E of Ardmore, 31 Oct 1942, *Hopkins 6333* (BM). COMANCHE CO: Caddo Lake, western edge of Wichita Mts Wildlife Refuge, 27 July 1967, *Crutchfield 3624* (LL); Fort Sill, 14 June 1916, *Clemens 11507* (GH). CRAIG CO: 10 mi N of Vinita, 19 June 1938, *Goodman 3043* (GH, UC, WTU). CREEK CO: Sapulpa, "Indian Territory," 30 July 1894, *Bush 616* (BM). GARFIELD CO: 1½ mi N of Breckinridge, 7 June 1941, *Gerhardt 413* (B). KAY CO: nr Toukawa, 5 Aug 1913, *Stevens 1889* (GH). LOVE CO: Lake Murray, 26 Sep 1970, *Correll & Correll 40034* (LL). MAYES CO: below dam at Disney, 11 Aug 1965, *Correll & Correll 31361* (LL). MCCURTAIN CO: N of Broken Bow, 19 July 1967, *Mitchell 3310* (LL). NOBLE CO: Perry, 27 June 1896, *Greiner s.n.* (DUKE). OTTAWA CO: Picher, 18 Sep 1970, *Correll & Correll 39827* (LL). PAYNE CO: Stillwater, 6 June 1916, *Learn 30* (UC). POTTAWATOMIE CO: 5 mi W of Asher, 29 June 1958, *Goodman 6643* (UC). WASHINGTON CO: near Copan, 15 Aug 1913, *Stevens 2113* (DS, GH).

TEXAS: BANDERA CO: 2 mi N of Vanderpool, 17 July 1957, *Correll & Johnston 18151* (LL). BASTROP CO: 2 mi SE of Cedar Creek, 3 May 1956, *McCart 5702* (DUKE, GH, TEX). BELL CO: 3 mi S of Temple, 9 Aug 1929, *Wolff 1084* (WTU). BEXAR CO: San Antonio, 4 May 1911, *Clemens 413* (UC); 15 mi NW of San Antonio, 18 Nov 1931, *Metz 235* (L, NY, WTU). BRAZORIA CO: Brazoria Nat'l Wildlife Refuge, 29 Mar 1967, *Fleetwood 9013* (TEX), 25 Aug 1967, *9113a* (TEX). BRAZOS CO: 6 mi NE of Benchley, 17 Nov 1940, *Curry 18* (CAS). BROWN CO: Brownwood, 19 June 1966, *Ewing 54* (LL, TEX). BURNET CO: Granite Mt., 25 July 1946, *Barkley & Johnson 6078* (TEX); 2 mi E of Burnet, 25 May 1966, *Crutchfield 1589* (LL). CALDWELL CO: no locality, 13 July 1943, *Barkley 13132* (MO, TEX, UC). CAMERON CO: near Brownsville, 6 May 1923, *Standley 713* (TEX); Laguna Atascosa Refuge, 21 Sep 1961, *Fleetwood 3815* (TEX); 20 mi N of Brownsville, 2 July 1941, *Runyon 2805* (TEX, UC). COMAL CO: Comanche Springs, New Braunfels, July 1849, *Lindheimer 1235* (BM, C, K, M, NY, TEX, UC). COOKE CO: 6 mi SW of Sivels Bend, 16 July 1967, *Crutchfield 3441* (LL). DALLAS CO: South Dallas, 27 June 1899, *Eggert s.n.* (BM); between Elam & Seagoville, 8 July 1944, *Lundell & Lundell 13804* (LL). DENTON CO: Lake Dallas Fish Hatchery, 15 Aug 1939, *McCart 1817* (MICH). ELLIS CO: ¾ mi S of Ferris, 10 July 1946, *Cory 53358* (DS, MICH, NY, UC). ERATH CO: 2 mi NE of Stephenville, 26 June 1950, *Gould 5660* (TEX, UC). GILLESPIE CO: just N of Fredericksburg, 29 June 1957, *Correll & Johnston 17265* (ENCB, LL). GONZALES CO: 7 mi S of Gonzales, 6 July 1957, *Correll & Johnston 17501* (LL, UC). HARRIS CO: Highlands, 12 Aug 1966, *Mears 686* (TEX); Houston, 13 July 1937, *Fisher s.n.* (UC). HIDALGO CO: near Mission, 13 July 1941, *Runyon 2634* (TEX); Mercedes, 21 Apr 1933, *Clover 949* (DS). JACKSON CO: 13 mi E of Edna, 11 Nov 1958, *Hotchkiss 7658* (LL). JEFF DAVIS CO: 18 mi N of Alpine, 1 Oct 1950, *Warnock 9797* (LL). JIM HOGG CO: 20 mi S of Mirando City, 21 Apr 1962, *Sanchez et al. 8302* (TEX). JIM WELLS CO: 5.7 mi S of Alice, 24 Nov 1954, *Johnston 542095* (TEX). KAUFMAN CO: 3¼ mi W of Forney, 14 July 1946, *Cory 53266* (DS, MICH, NY, UC, WTU). KLEBERG CO: near Kingsville, 9 Apr 1933, *Clover 838* (MICH). LAMAR CO: 5 mi N of Paris, 5 June 1961, *Johnston 6269* (LL). LAMPASAS CO: Lampasas, June 1885, *Reverchon 3588* (BM, GH, UC). LLANO CO: 6 mi W of Llano, 5 Oct 1933, *Cory 6361* (GH). MCLENNAN CO: McLennan, 30 June 1947, *Smith 815* (TEX). NUECES CO: Corpus Christi, 14 May 1915, *Young 5* (UC). PALO

PINTO CO: Strawn, 27 June 1918, *Palmer 14259* (B, MO). PARKER CO: Weatherford, 6 June 1902, *Tracy 7967* (BM, TEX). PRESIDIO CO: near Vieja Pass, 16 July 1941, *Hinckley 1996* (TEX). REFUGIO CO: 9 mi W of Refugio, 16 June 1957, *McCart 6839* (DUKE). ROCKWALL CO: 1¼ mi NE of Rockwall, 26 June 1946, *Cory 53321* (MICH, UC). SAN SABA CO: 20 mi S of Richland Springs, 7 June 1966, *McCart & McMillan 22* (LL, TEX). STEPHENS CO: Blackman's Lake, 22 June 1941, *Tharp s.n.* (B, TEX, UC). TARRANT CO: Tarrant, 1 Aug 1940, *McCart 2118* (TEX). TAYLOR CO: Lake Lytle nr Abilene, 13 June 1943, *Tolstead 7434* (GH, MICH, UC). TRAVIS CO: near Barton Springs Creek, 23 July 1943, *Barkley 13395* (B, TEX); W of Austin, 3 May 1921, *Tharp 1023* (TEX). UVALDE CO: Uvalde, 14 Oct 1916, *Palmer 11032* (DS, MO). VAL VERDE CO: 11.1 mi NW Del Rio, 30 Aug 1965, *Kral 25786* (ENCB). WEBB CO: about 19 mi S of Catarina, 7 June 1945, *Lundell & Lundell 13803* (LL, TEX). WICHITA CO: 4½ mi N and ½ mi W of Iowa Park, 30 Sep 1960, *Mahler 1402* (TEX); Wichita Falls, 1926, *McKee s.n.* (TEX). WILLACY CO: Raymondville, 18 Apr 1941, *Runyon 2664* (DS, DUKE, MICH, TEX, UC); 19 mi E of Raymondville, 12 July 1957, *Correll & Johnston 17878* (LL).

COLORADO: BOULDER CO: Base Line Lake, 25 Oct 1958, *Weber 11149* (C).

ARIZONA: COCONINO CO: Flagstaff, 2 Aug 1884, *Jones s.n.* (DS).

WASHINGTON: KLICKITAT CO: sandy banks of Columbia River, Oct 1885, *Suksdorf 83* (WTU). WHITMAN CO: Almota, 26 Aug 1894, *Piper s.n.* (NY).

OREGON: JACKSON CO: 10 mi SE of Sam's Valley, 16 July 1936, *Peck 19341* (CAS). KLAMATH CO: Swan Lake Valley, 1895, *Applegate 765* (DS). MARION CO: 1 mi N of Salem, 24 Aug 1921, *Nelson 4160* (UC). MULTNOMAH CO: no locality, July 1877, *Howell 393* (GH).

CALIFORNIA: COLUSA CO: Butte Sink Pond 2.7 mi N of Colusa, 6 Aug 1946, *Mason & Grant 12969* (CAS, DS, UC, WTU); Davis Tule, near Sycamore Slough, 11 July 1916, *Stinchfield 465* (DS, UC). FRESNO CO: 4 mi N of Sanger, 4 June 1936, *Hoover 1259* (UC). SISKIYOU CO: Oak Knoll Ranger Station, Siskiyou Mts, 11 Oct 1934, *Wheeler 3317* (CAS, DS, JEPS, LL, NO, TEX, UC, WTU). STANISLAUS CO: Modesto Reservoir, 27 July 1935, *Hoover 699* (UC). TULARE CO: Woodlake, 4 June 1936, *Hoover 1284* (UC); 8 mi N of Visalia, 26 July 1941, *Bacigalupi et al. 2507* (DS, GH, LL, UC, WTU). VENTURA CO: Mirror Lake, Ojai Valley, 12 Aug 1952, *Pollard s.n.* (CAS, UC).

MEXICO: COAHUILA: Tinaja Mesa Grande, high mesas 40 km NW of Hacienda de la Encantada, 14 Sep 1941, *Stewart 1638* (TEX); Santa Rosa Mts, 27 July 1938, *Marsh 1494* (F, TEX).

Cyperus distinctus Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.] : 24. 1854. Type: United States, no specimen found, but description adequate for typification. Figure 11(I–K).

Cyperus virens Michaux var. *brittonii* C. B. Clarke in Urban, Symb. Antill. 2: 26. 1900. Type: Florida, low grounds, Indian River, August, *A. H. Curtiss 3062* (K!, lectotype; CAS!, F!, GH!, M!, MICH!, MO!, NY!, isolectotypes).

Tufted perennial up to 90 cm tall; stems erect, rigid, round, smooth, stramineous, light green or brown, 2–4.5 mm wide distally, 3.5–6 mm wide at the base; leaves 4–13, about as long as the stem, 35–70 cm long; leaf sheath 5–15 cm long, brown or reddish brown, sometimes with sparse and inconspicuous transverse septa between the veins, weakly nodulose, occasionally persistent and becoming fibrous the second year; leaf blade 4–9 (–12) mm wide at mid-length, usually flat, stramineous to green, acute to attenuate at apex; involucral bracts 5–10, foliaceous and spreading, up to 50 cm long, 2–7 mm wide, sheathless or with a sheath less than 3 mm long, usually flat, stramineous to light green, with sparse to common inconspicuous transverse septa between the veins, nodulose, apically acute; compound inflorescence 3–13 cm long; primary peduncles 5–9 (–14), 3.5–10 cm long, 1–1.6 mm wide, round, smooth, rigid; secondary peduncles absent or 1–6, up to 2 cm long, 0.5–1 mm wide, straight; heads hemispherical, the primary ones 10–20 mm wide and with 35–60 spikelets, the secondary ones 8–12 mm wide and with 25–35 spikelets; bracteoles ovate, 3 mm long, 5–7-veined, chartaceous, apically mucronate; prophyll of spikelet 1–1.5 mm long, membranous to crustaceous, 3-veined; spikelets ovate, (3.5–) 5–12 (–14) mm long, 2.5–3.5 (–4) mm wide, apically obtuse to acute, with 10–32 scales; rachilla 0.25–0.4 mm wide, ca 0.2 mm thick, straight, stramineous with reddish brown longitudinal striations, the transverse scale scars 0.5–0.6 mm apart on each side; scale angles (35°–) 45°; scales 2–2.2 (–3) mm long, 0.8–1.4 mm wide, or 0.6–0.7 mm

wide and triangular in lateral view, adaxially with sparse yellow or red glands, apically acuminate to mucronate and straight, distinctly bicarinate basally, the proximal abaxial groove between the two keels 1.3–1.8 mm long; medial part of scale subcartilaginous, green to golden brown, usually smooth distally; sides of scale mostly chartaceous, tough and reticulate with large cells when young but becoming smooth and glossy when mature, golden brown to brown, the margins slightly revolute on the upper one-half or for the full length of the scale, basally attached to the rachilla for ca 0.4 mm; stamen solitary, 2–2.8 mm long, the filament 1.2–2 mm long, the anther ca 1 mm long; pollen 25–30 μ in diameter; style ca 1 mm long, the stigmatic branches 0.5 mm long; achene filling ca three-fourths of the scale, bilaterally symmetric, dark brown, narrowly trigonous, obtusely to acutely angled, four times longer than wide, 1.5–2 mm long (total length), the white to light or dark brown spongy and torulose base 0.2 mm long and as wide as the achene, the body 1.1–1.4 mm long, the slender apical beak 0.2 mm long; achenial surfaces of unequal width, 0.2–0.3 mm wide adaxially, 0.3–0.4 mm wide abaxially, narrowly elliptic, planar.

Distribution. Known collections are from South Carolina, Georgia, Florida, and Louisiana, and from the Bahamas. Long and Lakela (1971) indicate that *C. distinctus* occurs in Brazil, but I did not find any collections from South America. Occurring on moist soil, frequently sandy peat, in marshes, fields, ditches, cypress swamps, or lowland pine woods, mostly near sea level (Fig. 6).

Discussion. The principal diagnostic feature for *C. distinctus* is the swollen base of the achene. The achene is bilaterally symmetric with the adaxial surface slightly narrower than the abaxial ones. The solitary stamen arises abaxially below the enlarged base of the achene, but the filament sometimes curves around the edge of the fruit and is pressed between the adaxial surface of the achene and the rachilla. The glossy and crustaceous scale subtending the achene has the longest proximal abaxial groove, 1.3–1.8 mm long, of all the taxa in the Luzulae group. The scales eventually abscise but not as readily as in most other taxa in the group. When the scale falls from the rachilla, it leaves a minute amount of hyaline tissue on the sides of the rachilla but not enough to create a truly "winged" condition.

The amount of morphological variation in *C. distinctus* is less than in other taxa in the Luzulae group. This may be linked to its limited occurrence and possibly corresponds with less opportunity to express genetic variation or to adapt to various environmental habitats. The presence of an enlarged spongy and torulose base of the achene that persists at maturity is a unique and probably specialized feature for *C. distinctus* and for the Luzulae group. Its presence increases the size, volume, and weight of the achene and predictably reduces dispersibility. The evolutionary significance of this structure appears to be in the restriction of the geographic range of *C. distinctus.*

A collection from Collier County, Florida (*Lakela 31165*) is presumed to be a hybrid between *C. distinctus* and *C. pseudovegetus* var. *pseudovegetus.* The achenes are abortive, but similar in outline to those of *C. distinctus,* and the scales are similar in texture and size to those of *C. distinctus,* but are arched forward like those in *C. pseudovegetus* var. *pseudovegetus.* The spikelets are aggregated into small hemispherical heads as in *C. pseudovegetus.*

Cyperus distinctus has frequently been misidentified as *C. virens.* Both are tall, robust perennials and have similar spikelets and scales, but differ in features of their achenes. Also, the stems of *C. distinctus* are round and smooth while those of *C. virens* are sharply angled and generally scabrous on the angles. The extensive distribution of *C. virens* overlaps with the geographically restricted *C. distinctus* only in the southeastern United States.

In the original description of *C. virens* var. *brittonii,* Clarke cited only one specimen, *l'Herminier n. 44,* which I have not found. The *Curtiss* specimen, here designated as the lectotype, was found in the type collection at Kew and was annotated by Clarke in 1892, eight years prior to the date of publication of the name.

Representative specimens:

UNITED STATES OF AMERICA: SOUTH CAROLINA: CHARLESTON CO: Sullivan's Island Rd, Charleston, Oct 1837, *Gibbes s.n.* (NY).

GEORGIA: MCINTOSH CO: W side of Sapelo Island, 20 Sep 1956, *Duncan 20578* (F, GH).

FLORIDA: BREVARD CO: Okeechobee region, 27 Oct 1903, *Fredholm 6184* (GH, NY). BROWARD CO: W of Pompano, 19 Jan 1930, *Moldenke 457* (DUKE, MO); 10 mi SE of Andytown, 22 Aug 1964, *Stimson 862* (DUKE, NO). CHARLOTTE CO: 3 mi E of Bermont, 8 Nov 1964, *Hodgson 219* (GH). COLLIER CO: Naples, June 1940, *Meebold 28067* (M). DADE CO: no locality, Nov-Dec 1903, *Eaton 302* (F, GH, LL); Miami, July 1877, *Garber s.n.* (GH). DIXIE CO: near Old Town, 13 July 1965, *Godfrey 65873* (LL, TEX). DUVAL CO: nr Jacksonville, 24 July–8 Oct 1894, *Curtiss 5238* (F, GH, K, MO); South Jacksonville, 27 Aug 1939, *Dyal s.n.* (TEX). FRANKLIN CO: Lanark, 6 Oct 1955, *Godfrey 54132* (GH, NY); Lanark Station, 8 Aug 1964, *Henderson 64-406* (CAS). GLADES CO: near Lakeport, no date, *Lovett 179* (DUKE). HAMILTON-MADISON CO: above Ellaville, 1 Oct 1955, *Godfrey et al. 53938* (GH, NY). HENDRY CO: about 4 mi W of La Belle, 15 Aug 1963, *Henderson 63-1607* (TEX). HIGHLANDS CO: Archbold Biological Station, 10 mi S of Lake Placid, 9 May 1945, *Brass 15188* (GH). LEE CO: vicinity of Fort Meyers, 4 May 1916, *Standley 159* (F, GH, MO, NY); Myers, marshes, July–Aug 1900, *Hitchcock 385* (GH, MO, NY); S of Fort Myers, 19 Feb 1930, *Moldenke 651* (DUKE, MO). MANATEE CO: no locality, no date, *Simpson s.n.* (MO). OSCEOLA CO: Lake Wilson Road, Kissimmee, 27 Sep 1937, *Singeltary s.n.* (DUKE). PALM BEACH CO: Palm Beach, 26 Dec 1895–11 Jan 1896, *Hitchcock 2105* (G). PASCO CO: Aripeka, 14 July 1958, *Kral 7301* (GH). PINELLAS CO: St. Petersburg, Sep 1935, *Rhoades s.n.* (GH). POLK CO: vicinity of Kissenger Spring, 15 mi S of Winter Haven, 15 Oct 1930, *McFarlin 3040* (MICH); vicinity of Crooked Lake, 30–31 Oct, *McFarlin 3551* (MICH); about 4 mi SW of Bartow, 13 July 1956, *Redfearn, Jr. 2694* (GH). SUWANNEE CO: no locality, June–July 1898, *Hitchcock 2103* (F). TAYLOR CO: about 5 mi S of the Jefferson County line, 12 Aug 1963, *Henderson 63-1496* (TEX). WAKULLA CO: St. Marks, 9 Aug 1965, *Godfrey 65902* (LL).

LOUISIANA: ORLEANS PARISH: Audubon Park, New Orleans, 11 Dec 1931, *Penfound s.n.* (NO).

BAHAMAS: NEW PROVIDENCE: Water hole, Southwest Bay, 2 Sep 1904, *Britton & Brace 485* (US).

Cyperus eragrostis Lamarck, Tabl. Encycl. Meth. 1: 146. 1791. Type: not seen (presumably at P; description applies to this taxon and the name is considered as the correct one). Figure 5 (I–L).

Cyperus monandrus Roth, Catalecta bot. 1: 3. 1797. Type: no locality or collector specified (B!, holotype).

Cyperus vegetus Willdenow, Sp. Pl. 1: 283. 1797. Type: no locality specified, *Bouché s.n.* (B, holotype in Willdenow Herbarium; photo of holotype, Mus. Bot. Berol. Film Nr. 1664/1, B!).

Cyperus vegetus Willdenow var. *compactus* Desvaux in Gay, Hist. Fís. Pol. Chile 6: 167. 1854?. Type: Chile, Santiago, *Gay s.n.* (B!, presumably an isotype).

Cyperus vegetus Willdenow var. *triangularis* Böckeler, Flora 42: 436. 1859. Type: no locality or collector specified (C!, neotype, annotated by Böckeler).

Cyperus serrulatus S. Watson, Proc. Amer. Acad. 17: 382. 1882. Type: California, Placer County, Auburn, Sep 1880, *Vasey s.n.* (NY!, isotype).

Cyperus vegetus Willdenow var. *trigonus* O. Kuntze, Rev. Gen. 3, pt. 2: 334. 1898. Type: Argentina, Córdoba, 16 Dec 1878, *Hieronymus s.n.* (NY!, lectotype); Argentina, Córdoba, in las Quintas, *Galander 20* (NY!, paratype).

Cyperus eragrostis Lamarck var. *compactus* (Desvaux) Kükenthal, Pflanzenreich IV. 20 (Heft 101): 179. 1936.

Cyperus eragrostis Lamarck forma *latifrons* Kükenthal, Pflanzenreich IV. 20 (Heft 101): 179. 1936. Type: Chile, Valdivia, in Sümpfen, 15 Dec 1898, *Buchtien s.n.* (B!, lectotype; L!, isolectotype).

Cyperus eragrostis Lamarck forma *tener* Kükenthal, Pflanzenreich IV. 20 (Heft 101): 179. 1936. Type: Argentina, Concepción del Uruguay, May 1875, *Lorentz 142* (B!, holotype).

Tufted perennial up to 90 cm tall; stems rigidly erect, triquetrous to round, smooth, grayish green, light green, or stramineous, 1.5–3 mm wide distally, 3–5 mm wide at the base; leaves 6–10, up to three-fourths as long as the stem, (10–) 25–50 cm long; leaf sheath 2–16 cm long, stramineous with red veins or often all dark reddish brown, with weak transverse septa between the veins, nodulose, occasionally persistent and becoming brownish black and fibrous the second year; leaf blade 5–8 (–12) mm wide at mid-length, flat or occasionally conduplicate, light green, grayish green, or stramineous, attenuate at apex; involucral bracts 4–8, foliaceous and spreading, 3–30 (–50) cm long, 1.5–8 (–12) mm wide, sheathless, flat or sometimes conduplicate, light green, grayish green or stramineous, with faint to prominent transverse septa between the veins, nodulose, apically attenuate; compound inflorescence 3.5–7 cm long; primary peduncles 3–10 or sometimes absent, 2.5–5 (–12) cm long, 1–1.2 mm wide, triquetrous, smooth, usually rigid; secondary peduncles absent or 1–3 (seldom present), up to 1.5 cm long, ca 0.8 mm wide, straight; heads globose, the primary ones (12–) 20–40 mm wide and with 40–70 spikelets, the secondary ones 12–20 mm wide and with 20–30 spikelets; bracteoles ovate, 4–5 mm long, 7–11-veined, coriaceous or membranous, apically cuspidate to caudate; prophyll of spikelet ca 1.5 mm long, coriaceous or membranous, 5–11-veined; spikelets oblong, 5–20 mm long, 2.2–3 mm wide, apically acute, with (12–) 20–30 (–50) scales; rachilla 0.3–0.4 mm wide, ca 0.2 mm thick, sometimes inconspicuously winged, straight, stamineous to dark reddish brown, the transverse scale scars 0.8 mm apart on each side; scale angles 30°–45°; scales 2–2.3 mm long, 1–1.4 mm wide, or 0.3–0.6 mm wide and triangular in lateral view, adaxially with several yellow or red glands mostly between the veins, apically acute and straight (excurved only in certain South American specimens), distinctly bicarinate basally, the proximal abaxial groove between the two keels 0.3–0.6 (–0.8) mm long; medial part of scale subcartilaginous, light brown or stramineous, occasionally scabrellate distally; sides of scale membranous, roughened and reticulate with large cells when young, becoming glossy and smooth when mature, golden brown, the margins hyaline and often revolute on the upper two-thirds to three-fourths of the scale, basally attached to the rachilla for 0.2 mm; stamen solitary, 2–2.5 mm long, the filament 1–1.3 (–1.8) mm long, the anther 1–1.2 mm long; pollen 28–30 μ in diameter; style 1–1.2 mm long, the stigmatic branches ca 0.5 mm long; achene filling two-fifths to one-half of the scale, radially symmetric (rarely bilaterally symmetric), black or dark brown, broadly trigonous, acutely angled, about two times longer than wide, 1.2–1.4 mm long (total length), the stipitate base 0.1 mm long or less and occasionally broadened, the body ca 1 mm long, and the slender apical beak 0.2–0.3 mm long; achenial surfaces usually equal in width, 0.5–0.6 mm wide, or rarely the adaxial surface 0.1 mm wider than the two abaxial ones, obovate, slightly concave.

Distribution. Except for a few probable introductions along the Atlantic coast in New Jersey, North Carolina, and Alabama, *Cyperus eragrostis* occurs naturally in North America only in Washington, Oregon, and California. It is more widespread in South America, occurring from Peru, Bolivia, and Surinam south to Brazil, Uruguay, Argentina, and Chile and also on the Juan Fernandez Islands and Easter Island. It is reported from Australia, the Canary Islands, and southern Europe. Habitats include marshes, moist sandy banks of streams or rivers, bogs, vernal pools, ditches, weedy roadsides, rocky crevices along streams, brushy serpentine slopes, and moist grasslands, from sea level to 800 meters in elevation (Fig. 7).

Discussion. Characterized by straight, acute apices, the scales of *C. eragrostis* are among the longest of any in the Luzulae group but they have one of the shortest proximal abaxial grooves, 0.3–0.6 (–0.8) mm long. The scales are about 0.8 mm apart on each side of the rachilla in contrast to 0.3–0.7 mm for related taxa. The achenes

Figure 7. Distribution of *Cyperus eragrostis.*

are broadly trigonous and usually radially symmetric and have surfaces that are equal in width and slightly concave.

Morphologically, *C. eragrostis* is less variable than other widespread taxa but more so than the geographically restricted *C. distinctus.* The most notable variation within *C. eragrostis* involves the lengths of the stems and the primary peduncles. Usually much taller, some mature plants are only about 10 cm tall and have been

described as *C. eragrostis* var. *compactus* (here synonymized); these diminutive forms can be found throughout the distribution of the species. Primary peduncles are usually rigid and evident, but in a few specimens they are absent and the compound inflorescence consists of a single, large, terminal head.

Cyperus eragrostis is geographically isolated from *C. distinctus* and *C. virens,* the two taxa to which it shows the greatest resemblance in habit. It can be distinguished from *C. distinctus* by its broadly trigonous achene lacking an enlarged base, and from *C. virens,* by its smooth, rather than scabrous or scabrellate, stem. The achenes of *C. eragrostis* resemble those of *C. acuminatus, C. ochraceus,* and *C. reflexus* var *reflexus* in that all are two to two and one-half times longer than wide and usually fill two-fifths to three-fifths of the scale. These taxa can be readily distinguished from *C. eragrostis* as follows: *C. acuminatus* is an annual, and has shorter spikelets and scales with excurved apices; *C. ochraceus* has convex or planar achenial surfaces and scales that are declined 60° to 90° from the rachilla; and *C. reflexus* var. *reflexus* has fewer and narrower leaves, shorter stems, red glossy scales, and usually an elongate and erect lowermost involucral bract.

Nomenclaturally, the main confusion concerning this taxon has been the frequent use of the name *C. vegetus* Willdenow in place of *C. eragrostis* Lamarck. Although I was unable to locate the type specimen, the original description of *C. eragrostis* Lamarck applies to this taxon.

Representative specimens:

UNITED STATES OF AMERICA: OREGON: CURRY CO: Siskiyou National Forest, 20.4 mi W of Glendale, 10 July 1973, *Denton 3169* (MICH, WTU); near Agness, 7 July 1929, *Henderson 11568* (UC); bog near Gold Beach, 24 July 1945, *Peck 23965* (WTU). JOSEPHINE CO: near Rouge River Rapids, 23 June 1931, *Peck 16354* (DS, UC). LANE CO: just N of Eugene, 6 Aug 1964, *Dennis 2636* (DS, GH, NY, WTU).

CALIFORNIA: ALAMEDA CO: Niles Canyon, near Sunol, 14 Aug 1933, *Purer 5440* (BM); near Decoto, 1 Oct 1933, *Ewan 8150* (UC). AMADOR CO: vicinity of Ione, June 1904, *Braunton 1012* (BM, DS, NY, UC); 3.6 mi W of Pine Grove, 1 July 1933, *Wolf 5154* (TEX, UC, WTU). BUTTE CO: near Oroville, 2 Oct 1896, *Brown 119* (L); Chico, 27 July 1903, *Copeland 3490* (F, GH, LL, LY, MICH, NY, UC). CALAVERAS CO: 1 mi NW of San Andreas, 18 July 1936, *Belshaw & Gifford 2503* (UC). COLUSA CO: 1.6 mi W of Williams, 5 Sep 1946, *Mason & Grant 13117* (UC). CONTRA COSTA CO: San Leandro Lake near mouth of Redwood Creek, 3 Dec 1940, *Morley 90* (DS, DUKE, GH, MICH, MO, NO, UC, WTU). DEL NORTE CO: Crescent City, no date, *Nobs & Smith 1313* (DS, UC). EL DORADO CO: 2 mi S of Pleasant Valley on road to Somerset, 3 May 1959, *Shannon 42* (WTU). FRESNO CO: Fish Creek, San Joaquin River, 21 May 1928, *Jepson 12877* (JEPS). GLENN CO: Orland, 26 Sep 1929, *Jepson 15276* (JEPS). HUMBOLDT CO: vicinity of Orick, 2 July 1962, *Barclay et al. 1279* (LL); Trinity River Valley, 17 July 1935, *Tracy 14099* (DS, TEX, UC). LAKE CO: Mt. St. Helena, 4 May 1940, *Carrillo & Sableman 9688* (UC). LOS ANGELES CO: San Gabriel Mts., Pine Canyon Dam, 20 Aug 1933, *Wheeler 2088* (JEPS). MADERA CO: 5 mi W of Coarsegold, Sierra Nevada, 2 May 1931, *Benson 2783* (DS, UC). MARIN CO: Phoenix Lake, Mt. Tamalpais, 24 Sep 1921, *Jepson 9500* (JEPS). MARIPOSA CO: 1 mi W of Indian Flat, 23 Sep 1960, *Rose 60101* (B). MENDOCINO CO: SE of Ukiah, 19 July 1943, *Jepson 20868* (JEPS). MERCED CO: nr Merced, 26 Oct 1894, *Congdon s.n.* (DS). MODOC CO: 1 mi N of Corning, 22 July 1947, *Grant & Schneider 8164* (B, UC). MONTEREY CO: just S of Carmel, 1 Apr 1970, *Howell 46514* (B); Prewitt Creek, 13 Apr 1961, *Hardham 7400* (CAS). NAPA CO: W side of Wooden Valley Grade, 1 Dec 1935, *Carter 1018* (UC). NEVADA CO: 9 mi E of Grass Valley, 12 June 1972, *Hansen & Hansen 904* (LL). ORANGE CO: Costa Mesa, back of Newport Bay, 15 June 1932, *Booth 1201* (JEPS, NO). PLACER CO: Auburn, 1845, *Ames s.n.* (LL), Aug 1894, *Ames s.n.* (GH); 2 mi S of Auburn, 15 Aug 1925, *Cain 4* (DS). RIVERSIDE CO: near Corona, 9 June 1917, *Crawford & Johnston 1256* (DS, F, MICH). SACRAMENTO CO: 5 mi SE of Folsom, 8 Aug 1936, *Yates 5949* (UC). SAN BERNARDINO CO: Lytle Creek below Mill St. Bridge, 9 Oct 1907, *Parish 6495* (DS, F, LY, TEX). SAN DIEGO CO: San Diego, 24 July 1923, *Fisher s.n.* (L). SAN FRANCISCO CO: Sag Pond at entrance to San Francisco county prison, 28 Aug 1946, *Grant & Mason 13083* (DUKE, UC). SAN JOAQUIN CO: 3.2 mi E of Escalon, 23 June 1934, *Wiggins 6937* (DS). SAN LUIS OBISPO CO: Graves Creek, Paradise Valley, 20 Aug 1950, *Hardman 1305* (CAS). SAN MATEO CO: near Lake San Andreas, 9 Oct 1926, *Howell 2216* (UC); Burlingame, 20 Sep 1965, *Rose 65107* (B, DS, ENCB, TEX, WTU). SANTA BARBARA CO: Santa Barbara, 18 Sep

1956, *Pollard s.n.* (CAS). SANTA CLARA CO: W. Palo Alto, 15 Aug 1959, *Thomas 8061* (DS); about 3 mi SE of Los Altos, 24 June 1954, *Thomas 4307* (DS). SANTA CRUZ CO: Mill Creek Dam, SW of Eagle Rock, 2 July 1954, *Hesse 1320* (CAS); about 5.5 mi E of Watsonville, 31 May 1953, *Thomas 3297* (CAS, DS). SHASTA CO: Redding, 17 Sep 1941, *Drouet & Richards 4272* (F), *4268* (F, WTU). SOLANO CO: N of Rio Vista, 17 Aug 1945, *Mason 12663* (DS, UC); Vacaville, 20 Oct 1942, *Jepson 20741* (JEPS). SONOMA CO: 4 mi SE of Sonoma, 29 Sep 1937, *Baker 6037* (C, UC). STANISLAUS CO: Modesto, 2 Oct 1938, *Hoover 3875* (UC); 1 mi N of Oakdale, 7 May 1936, *Jepson 17534* (JEPS). SUTTER CO: 5 mi W of Live Oak, 9 May 1936, *Ewan & Ewan 9534* (JEPS, NO, UC). TEHAMA CO: 2 mi SE of Beegum, 15 June 1943, *Pitelka 202* (UC). TULARE CO: near Soda Springs on Indian Reservation, 13 June 1964, *Smith 1265* (JEPS, WTU). TUOLOMNE CO: Spring Gulch near Bear Creek, 23 May 1919, *Williamson 190* (DS, UC). VENTURA CO: Mirror Lake, Ojai Valley, 12 Aug 1952, *Pollard s.n.* (CAS, UC). YUBA CO: Swartsville, 29 July 1934, *Jepson 16760* (JEPS).

SURINAM: NICKERIE: Wageningen, van Hortus Kopenhagen, 24 Sep 1953, *Boom 531928* (L).

PERU: APURIMAC: Chincheros, 1 Nov 1935, *West 3686* (GH, UC). CAJAMARCA: km 127 E of Olmos on Rio Huancabamba, 12 Jan 1964, *Hutchinson & Wright 3553* (UC).

BOLIVIA: COCHABAMBA: grounds of the Colegio Americana Primera at Cochabamba, 7 Mar 1939, *Eyerdam 24662* (UC); vic. Cochabamba, 1891, *Bang 1072* (M, MICH, NY).

BRAZIL: PARANA: Mun. União de Vitória, Estr. p/Pôrto Vitoria, 16 Oct 1966, *Hatschbach 14091* (L); Mun. Piraquará, Rio Bracajuvava, 10 Oct 1966, *Hatschbach 14831* (L). RIO DE JANEIRO: near Rio de Janeiro, 1838–42, *Capt. Wilkes Expedition s.n.* (GH). SANTA CATARINA: Matos Costa, 9 Dec 1962, *Klein 3.606* (L); Serra de Boa Vista, São José, 10 Nov 1960, *Reitz & Klein 10.391* (L).

URUGUAY: CANELONES: Independencia, Nov 1926, *Herter 81306* (B, M); Jolero, 15 Jan 1938, *Osten 21857* (GH), 25 Feb 1928, *Osten 19328* (F, GH). COLONIA: La Estanzuela, 14 Jan 1944, *Bartlett 21295* (MICH). MALDONADO: Isla Lobos, 4 Jan 1941, *Descole 55* (GH, UC). MONTEVIDEO: Atahualpa, Dec 1925, *Herter 79875* (M); Miguelete, 1938, *Herter 60833* (B). RIVERA: Cuñapirú, 1928, *Wright s.n.* (BM). SAN JOSE: Santa Lucía, 25 Nov 1929, *Osten 21693* (GH).

ARGENTINA: BUENOS AIRES: San Isidro, 19 Dec 1942, *Bartlett 19248* (MICH); Campana, 27 Nov 1938, *Beetle 23069* (UC); Buenos Aires, 19 Mar 1945, *Alvarez 671* (F), 19 Nov 1938, *Beetle 23015* (UC), 26 Nov 1912, *Rodriguez 89* (TEX); Tigre, 21 Dec 1942, *Bartlett 19266* (MICH); Elizalde, 27 Dec 1929, *Cabrera 1269* (GH). CATAMARCA: El Rodeo (S. Ambato), Feb 1941, *Parodi 14227* (GH); Dept. Andalgala, Estancia Yunka Suma, Río Chacra, 2 Nov 1950, *Sleumer 61* (B). CORDOBA: La Falda, 1932, *Jordan s.n.* (GH); Estancia Germania, June-Dec 1874, *Lorentz 120* (BM, M); Córdoba, Nov 1878, *Hieronymus s.n.* (BM). CORRIENTES: Dept. Curuzú Cuatiá, Ruta 14, 13 Nov 1964, *Pedersen 7127* (C). ENTRE RIOS: Dept. Federación, Buena Esperanza, 13 Dec 1957, *Pedersen 4707* (C). MENDOZA: St. Rosa, 1904–05, *Virven-Haarings s.n.* (C). RIO NEGRO: vicinity of General Roca, Sep 1914–Feb 1915, *Fischer 200* (BM, F). SALTA: Dept. Rivadavia, Marguesado, 27 Nov 1945, *Cuezzo 1493* (MO). SAN JUAN: Desamparador, Localidad chimba's, 16 Nov 1945, *Cuezzo 1133* (MO). TUCUMAN: San Pedro de Colalao de Colalao, 9 Mar 1917, *Castillón 154* (GH); Dept. Burruyaco, Cerro el Nogalika, Apr 1929, *Venturi 8825* (GH); Dept. Chicligasta, Estancia Las Pavas, Sep 1925, *Venturi 4049* (UC).

CHILE: ACONCAGUA: Valle de Marga-Marga SE from Valparaíso, no date, *Jaffuel & Pirion 3301* (GH). ARAUCO: Arauco, 6 Mar 1925, *Pennell 12939* (GH). CAUTIN: Tenuco, Jan 1933, *Montero 1178* (GH). CONCEPCION: 2 mi NE of Florida, 18 Feb 1958, *Eyerdam 10696* (F, NY, UC). COQUIMBO: Rivadavia, Dec 1923, *Werdermann 174* (BM, F, GH, M, NY, UC), *167* (BM). MALLECO: Angol, "El Vergel," 21 Nov 1933, *Marillan 182* (UC); El Vergel, 10 km S of Angol, 30 Dec 1935, *West 4935* (UC). SANTIAGO: vicinity of Santiago, mts near Río Colorado, 15 Feb 1902, *Hastings 549* (UC). VALDIVIA: in Sümpfen, 15 Dec 1898, *Buchtien s.n.* (L). VALPARAISO: 20 km N of Valparaíso, 16 Feb 1939, *Beetle 26103* (UC); El Tranque, Vina del Mar, ca 12 km from Valparaíso, 10 Dec 1938, *Morrison 16834* (MO, UC); forest near Quintero, 10 Jan 1952, *Poulsen s.n.* (C). JUAN FERNANDEZ ISLANDS: Masafuera, rocks between Curois and Vacas, 13 Feb 1917, *Skottsberg & Skottsberg 426* (BISH, BM); Masafuera, Quebrada Vacas, 28 Nov 1965, *Solbrig et al. 3673* (GH, MICH); Masatierra, from Cumberland Bay to Quebrada Puerto Francés, 16-17 Dec 1964, *Solbrig et al. 3871* (GH, NY, UC), near Cumberland Bay, 4 May 1939, *Morrison 17402* (UC). EASTER ISLAND: Rano Kao, edge of marshy crater floor, 15 Jan 1935, *Chapin 1015* (BISH).

Cyperus intricatus Schrader ex J. A. Schultes in Roemer & Schultes, Syst. Veg. Mantiss. 2: 98. 1824. Type: Brasil, *Prinz von Wied-Neuwied* ["In Brasilia, Princ. Ser. Max. Neowid."] (LE?, holotype, not seen). Figure 8.

Cyperus consanguineus Kunth, Enum. Pl. 2: 42. 1837. Type: Brasilia meridionalis, *Sello 4800* (B!, holotype).

Cyperus chamissoi Schrader ex Nees in Martius, Flora Brasil. 2, pt. 1: 33. 1842. Type: in insula S. Catharinae Brasiliae (not seen, but description fits *C. intricatus*; collections by *Chamisso s.n.* and *Eschscholz s.n.* are cited in protologue; one of these could serve as a lectotype if located).

Cyperus widgrenii Böckeler, Bot. Jahrb. Syst. 5: 499. 1884. Type: Brasil, Prov. Minas Gerais, 1845, *Widgren s.n.* (B!, holotype).

Cyperus schenckianus Böckeler, Beitr. Cyper. 2: 4. 1890. Type: Brasil, Prov. Sta. Catharina, Blumenau, 18 Oct 1886, *Schenck s.n.* (B!, holotype).

Cyperus ciliolatus Böckeler, Beitr. Cyper. 2: 5. 1890. Type: Brasil, Prov. Sta. Catharina, Campo Allegre, Foinville, São Bento, 24 Nov 1886, *Schenck 1312* (B!, holotype).

Cyperus longicaulis Böckeler, Allg. Bot. Z. Syst. 1: 202. 1895. Type: Brasil, Prov. Santa Catharina, im sumpfe auf dem Campo der Serra do Oratorio, Jan 1880, *Ule 1602* (B!, holotype).

Cyperus varius Böckeler, Allg. Bot. Z. Syst. 1: 202. 1895. Type: Argentina, Laguna, Cordillera de Misiones, *Niederlein 2154* (B!, holotype).

Cyperus usteri Palla, Oesterr. Bot. Z. 66: 257. 1907. Type: Brasil, São Paulo, Ipiranga, 7 Dec 1906, *Usteri 8* or Horto Oswaldo Cruz n. 9363 (B!, isotype).

Cyperus consanguineus Kunth var. *chamissoi* (Schrader ex Nees) Kükenthal, Pflanzenreich IV. 20 (Heft 101): 171. 1936.

Cyperus consanguineus Kunth var. *varius* (Böckeler) Kükenthal, Pflanzenreich IV. 20 (Heft 101): 171. 1936.

Cyperus consanguineus Kunth var. *usteri* (Palla) Kükenthal, Pflanzenreich IV. 20 (Heft 101): 171. 1936.

Cyperus reflexus Vahl var. *intricatus* (Schrader ex J. A. Schultes) Kükenthal, Pflanzenreich IV. 20 (Heft 101): 174. 1936.

Cyperus virens Michaux var. *widgrenii* (Böckeler) C. B. Clarke ex M. Barros, Anales Mus. Argent. Ci. Nat. "Bernardino Rivadavia" 39: 294. 1938.

Tufted perennial up to 50 (–88) cm tall; stems erect, triquetrous, sometimes flexuous, smooth or scabrellate on the angles, grayish green, green, or stramineous, 2.2 mm wide distally, 4 mm wide at the base; leaves ca 4, usually ca one-half as long as the stem, but sometimes fully as long as the stem, up to 48 cm long; leaf sheath up to 19 cm long, dark red to reddish purple, usually with conspicuous transverse septa between the veins, faintly to prominently nodulose, sometimes persistent and becoming dull brown and somewhat fibrous the second year; leaf blade 5 (–11) mm wide at mid-length, conduplicate or flat, grayish green, green, or stramineous, attenuate at apex; involucral bracts 4–8, usually foliaceous and spreading but the lowermost and longest bract sometimes ± erect, up to 28 cm long, up to 9 (rarely –16) mm wide, generally sheathless, conduplicate or flat, grayish green, green, or stramineous, occasionally with transverse septa between the veins, nodulose, apically attenuate; compound inflorescence 5–6 cm long; primary peduncles 6–13, up to 8 cm long, up to 1.2 mm wide, round or flattened, sulcate, prominently scabrellate, stiff to flexuous; secondary peduncles 1–4 (–7), up to 3 cm long, up to 0.7 mm wide, flexuous; heads hemispherical, the primary ones up to 13 mm wide and with ca 60 spikelets, the secondary ones up to 8 mm wide and with ca 30 spikelets; bracteoles ovate, 3–7 mm long, 5–11-veined, membranous to coriaceous, apically attenuate to caudate; prophyll of spikelet up to 3 mm long, membranous, 3–5-veined; spikelets broadly ovate, 4–6 mm long, 3.5–4 mm wide, apically obtuse to acute, with 8–14 scales; rachilla ca 0.3 mm wide, ca 0.1 mm thick, mostly straight, dark reddish black or dark red, the transverse scale scars ca 0.5 mm apart on each side; scale angles 30°–45°; scales 2–3 mm long, 1.2–1.6 mm wide, or 0.5–0.8 mm wide and either triangular or lunate in lateral view, adaxially with a few red glands, apically mucronate and straight or sometimes subtly excurved, weakly bicarinate basally, the proximal abaxial groove between the two keels 0.6–0.8 mm long; medial part of scale firmly membranous to cartilaginous, pale green, light reddish brown to stramineous, prominently scabrellate distally (rarely smooth); sides of scale chartaceous and reticulate with large cells, or sometimes smooth and glossy when mature, red, reddish black, reddish brown, or light brown, the margins mostly papyraceous, hyaline only on the outermost 0.1 mm,

sometimes revolute on the lower three-fifths of the scale, basally attached to the rachilla for 0.2 mm; stamens one or two, 3.5–4.5 mm long, the filaments 2.5–3 mm long, the anthers 1.1–1.8 mm long, the connective extended less than 0.1 mm apically; pollen 25–30 μ in diameter; style 0.8–1.2 mm long, the stigmatic branches 0.6–1.0 mm long; achene filling two-fifths to three-fourths of the scale, radially symmetric (rarely asymmetric), light to dark brown or brownish black, narrowly to broadly trigonous, acutely to obtusely angled, two and one-half to five times longer than wide, 1.2–1.5 mm long (total length), the stipitate base 0.1–0.2 mm long and ca 0.15 mm wide, the body 0.8–1.3 mm long, and the slender apical beak up to 0.2 mm long; achenial surfaces ± equal in width, 0.4–0.5 (–0.6) mm wide, mostly obovate (infrequently elliptic), planar to slightly concave.

Figure 8. A–E. *Cyperus intricatus* (based on *Reitz & Klein 10.581*); A, inflorescence, × ½; B, spikelet, × 5; C, scale, × 15; D, achene, × 15; E, surface of peduncle, × 20.

Distribution. One of the most restricted taxa in the Luzulae group, *C. intricatus* occurs in southern Brazil and northeastern Argentina. Found in moist places, usually near lakes or streams (elevations not available) (Fig. 10).

Discussion. Important features for differentiating *C. intricatus* are its scabrellate peduncles, broadly ovate spikelets, obovate achenial surfaces, usually two stamens per flower, and long, slender scales that do not readily disarticulate from the rachilla. The straight or inwardly arched scales typically have red or reddish brown sides and prominent crystalline hairs or teeth distally. The lowermost involucral bract is often stiff and erect and appears like a prolongation of the stem.

The presence or absence of peduncles in the inflorescence appears to lack significance for recognizing infraspecific ranks but is one of the most conspicuous aspects of variation in this species. As in several other taxa (*C. eragrostis, C. luzulae,* and *C. reflexus*), the compound inflorescence may consist either of a single large head terminating the stem or of a complex branching system with the heads on primary and secondary peduncles. The widths of the foliage leaves and involucral bracts are also variable. The type specimen of *C. intricatus,* unfortunately, is not typical for the species, as its involucral bracts are only about one millimeter wide and it is more diminutive than other specimens; however, its spikelets, scales, and achenes are characteristic.

The presence of usually two stamens per flower and of scales that disarticulate tardily, if at all, tend to make *C. intricatus* a borderline taxon in the Luzulae group. Only one other related species, *C. virens,* has one or two stamens per flower, and only *C. distinctus* has scales that do not abscise so readily. The retention of the scales on the rachilla might serve to reduce the dispersibility of their enclosed achenes; the restricted geographic distribution of *C. intricatus* may be explained by this structural feature of the spikelet. The similarity of the spikelet structure, and of vegetative features, of *C. intricatus* to others in the Luzulae group, warrant its inclusion here.

Representative specimens.

BRAZIL: MINAS GERAIS: no locality, 1845, *Widgren s.n.* (B, M). PARANA: Mun. Piraquara, Rio Bracajuvava, 10 Nov 1966, *Hatschbach 14831* (NY); Mun. S. José dos Pinhais, 31 Nov 1961, *Hatschbach 8292* (B). RIO GRANDE DO SUL: Farroupilha, 31 Oct 1957, *Camargo 2234* (B), 15 Nov 1956, *Camargo 924* (B); Taquari, 8 Dec 1957, *Camargo 2723* (B); Mun. Santa Cruz, Pinhal, Feb 1925, *Jürgens 95* (B); Mun. Venanrio, Ayres, Tanjerinas, Dec 1923, *Jürgens 81* (B); S. Fr. de Paula, Vila Oliva, 16 Jan 1946, *Rambo S. J. 33173* (MO). SANTA CATARINA: Serra da Boa Vista, São José, 26 Dec 1960, *Reitz & Klein 10.581* (UC); Campo de Areão, Santa Cecilia, 19 Dec 1962, *Reitz & Klein 14.167* (B); Blumenau, 18 Oct 1886, *Schenck 740*; São Bento, 24 Nov 1886, *Schenck 1312* (B); Mun. Campo Alegre, 9 Nov 1956, *Smith & Klein 7464* (NY); bei Itajahy, Nov 1885, *Ule 555* (B); no locality, Nov 1889, *Ule 1372* (B), Jan 1890, *Ule 1602* (B). SAO PAULO: Ypiranga, 7 Dec 1906, *Usteri 9363* (B).

ARGENTINA: MISIONES: Laguna, Cordillera Misiones, 7 Dec 1886, *Niederlein 2154* (B).

Cyperus luzulae (Linnaeus) Retzius, Obs. Bot. 4: 11. 1786. Basionym: *Scirpus luzulae* Linnaeus, Sp. Pl., ed. 2. 75. 1762. Type: No. 71.45 of the Linnaean Herbarium (LINN, holotype, IDC microfiche!). Figure 13 (L–O).

Cyperus conoideus L. C. Richard in Actes Soc. Hist. Nat. Paris 1: 106. 1792. Type: no locality specified, *Richard s.n.* (P, holotype; C!, isotype).

Cyperus sphaerostachys Link, Jahrb. Gewächsk. 1 (Heft 3): 89. 1820. Type: America meridionale, *Humboldt s.n.* (B, holotype in Willdenow's herbarium; photo, Mus. Bot. Berol. Film Nr. 2534, B!).

Cyperus trinitatis Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.]: 26. 1854. Type: in insl. Trinitatis, *Sieber. fl. Tr.* 1 (M!, isotype).

Cyperus luzulae (Linnaeus) Retzius var. *minor* Böckeler, Linnaea 35: 561. 1868. Type: Surinam, *Hostmann s.n.* (B!, holotype).

Cyperus entrerianus Böckeler, Flora 61: 139. 1878. Type: Argentina, Concepción del Uruguay, April 1876, *Lorentz s.n.* (B!, holotype).

Cyperus tucumanensis Böckeler, Bot. Jahrb. Syst. 7: 274. 1886. Type: Argentina, Tucumán, 29 Dec 1872, *Lorentz & Hieronymus 1086* (B!, holotype).

Cyperus pseudosurinamensis Böckeler, Allg. Bot. Z. Syst. 1: 201. 1895. Type: in insula Martinica, *Hahn s.n.* (B!, fragment of holotype).

Cyperus luzulae (Linnaeus) Retzius var. *tucumanensis* (Böckeler) C. B. Clarke, Bull. Herb. Boiss. II. 3: 1007. 1903.

Cyperus bangianus Gandoger, Bull. Soc. Bot. France 66: 297. 1920. Type: Bolivia, Yungas, 1890, *Bang 531* (BISH!, C!, L!, M!, NY!, isotypes).

Cyperus guatemalensis Gandoger, Bull. Soc. Bot. France 66: 297. 1920. Type: Guatemala, Alta Verapaz, *Türckheim 128* (NY!, isotype).

Cyperus luzulae (Linnaeus) Retzius forma *pallidiflorens* Kükenthal, Pflanzenreich IV. 20 (Heft 101): 171. 1936. Type: Dominican Republic, Prov. Santo Domingo, Llano Costero, Cuenca, in moist savannas, *Ekman 10975* (F!, NY!, isotypes).

Cyperus entrerianus Böckeler var. *parvicapitatulatus* Kükenthal, Pflanzenreich IV. 20 (Heft 101): 170. 1936. Type Colombia, Macondo-Wald, an nassen stellen, 10 June 1927, *A. Schultze 935* (B!, holotype).

Cyperus luzulae (Linnaeus) Retzius var. *entrerianus* (Böckeler) M. Barros, Anales Mus. Argent. Ci. Nat. "Bernardino Rivadavia" 39: 309. 1938.

Tufted perennial up to 50 (–92) cm tall; stems rigidly erect, round or roundly triquetrous, smooth, green, grayish green, or stramineous, 1–2 mm wide distally, 2–3.5 mm wide at the base; leaves (3–) 6–10, one-half as long to as long as the stem, 15–54 (–70) cm long; leaf sheath 2–14 cm long, sometimes with red glands adaxially, stramineous, brown, or dark reddish brown, with or without transverse septa between the veins, sometimes nodulose, often persistent and becoming dull brown the second year; leaf blade 5–12 mm wide at mid-length, usually flat, green, or grayish green, acute at apex; involucral bracts 7–12, foliaceous and spreading, usually flat, 7–70 cm long, 1–7 mm wide, usually with a small sheath ca 0.1 mm long or sheathless, green or grayish green, with inconspicuous transverse septa between the veins, faintly nodulose, apically acute; compound inflorescence up to 7 cm long; primary peduncles 4–10 or absent, 1–7 cm long; 1–1.3 mm wide, round or triquetrous, smooth, rigid; secondary peduncles usually absent or 1–2, up to 1 cm long, ca 0.5 mm wide, straight; heads often appearing pyramidal or cylindrical, seldom spherical or hemispherical; primary heads 10–15 mm long and ca 10 mm wide, with 75–150 spikelets; secondary heads barely pedunculate if at all, 10–13 mm long and 7–10 mm wide, with 50–100 spikelets; bracteoles ovate, ca 3 mm long, 7-veined, coriaceous, membranous, apically cuspidate to caudate; prophyll of spikelet ca 1 mm long, membranous, 7 (–or more)-veined; spikelets ovate, 1.5–4.5 mm long, 0.8–2.2 mm wide, apically rounded, with 6–18 scales; rachilla 0.15–0.2 mm wide, ca 0.15 mm thick, rarely winged, usually arched (rarely straight), green when immature or stramineous, brown, or dark reddish brown, the transverse scale scars ca 0.5 mm apart on each side; scale angles 30°–45°; scales 1–1.5 mm long (–2 mm only in several South American specimens), 0.6–0.8 (–1) mm wide, or ca 0.4 mm wide and either triangular or lunate in lateral view, adaxially with red, glandular, longitudinal striations, apically obtuse to rounded and incurved, distinctly bicarinate basally, the proximal abaxial groove between the keels 0.8–1.4 mm long; medial part of scale subcartilaginous, dull white, stramineous or light brown, seldom scabrellate distally; sides of scale membranous, opaque and reticulate with large cells but often becoming glossy when mature, usually stramineous, or occasionally golden brown or reddish brown, the margins hyaline and revolute on the upper two-thirds to three-fourths of the scale, basally attached to the rachilla for 0.2 mm; stamen solitary, 1–1.5 (–2) mm long, the filament 0.5–1.5 mm long, the anther 0.5–0.7 mm long; pollen ca 25 μ in diameter; style ca 0.5 mm long, the stigmatic branches ca 0.3 mm long; achene filling three-fourths to all of the scale, bilaterally symmetric, brown to black, narrowly trigonous, obtusely angled, falcate, four to five times longer than wide, 0.9–1 (–1.2) mm long (total length), the stipitate base up to 0.1 mm long, the body 0.7–1 mm long, and the slender apical beak

0.1–0.2 mm long; achenial surfaces equal or slightly unequal in width, the adaxial surface either wider than, equal to, or narrower than the two abaxial ones, 0.2–0.3 mm wide, elliptic to slightly ovate or obovate, planar to scarcely convex.

Distribution. A wide-ranging species found in the Greater and Lesser Antilles, and in Florida and Texas, south through Mexico, Central America, and South America to Argentina, growing in sandy or silty soils in deciduous or mixed evergreen forests, pastures, ditches, meadows, or along streams or logging roads from sea level to 1500 meters in elevation (Fig. 9).

Discussion. The achenes of *C. luzulae* are characteristically small, bilaterally symmetric and four to five times longer than wide and fill three-fourths or more of the scales. The stipitate base of the achene is less well developed than in most other taxa but similar to that of *C. pseudovegetus.* Morphologically, *C. luzulae* most closely resembles *C. pseudovegetus* var. *megalanthus.*

The coloration of the scale is usually diagnostic with the medial part white or stramineous and the sides stramineous. In South America, however, the sides of the scale are occasionally reddish brown. The scales are short, only 1–1.5 mm long, except in certain South American specimens in which they may be up to 2 mm long. The surface of the scale is generally dull, but may be glossy at maturity. Although the scale apices are typically round or obtuse, they may vary from round to acute on a single head in some plants. The acute apex is not apt to be noted except in mature scales, as the apex is often incurved when the scales are immature.

Conspicuous variation in the plants can be noted in the lengths of the primary and secondary peduncles. The primary peduncles are usually evident and longer than one centimeter. The plants which bear sessile heads are mostly restricted to Panama, except for a collection from Colombia in which one plant bore sessile heads and another plant bore pedunculate ones. The typical pyramidal or cylindrical heads of the compound inflorescence are created when the few secondary peduncles are so short that they are obscured by the spikelets.

In a few collections from Oaxaca, Mexico, the number of spikelets in the individual heads is about one-third that of other collections. This tends to make these plants appear distinctive in comparison with those of other populations, but the features of the achenes, scales, stems, and leaves remain so similar that segregation of a new taxon does not seem warranted. Such reduction in the number of spikelets and corresponding number of achenes (seeds) undoubtedly affects the reproductive potential of the plants.

There are two modes of variation in *C. luzulae* reflected by the nature of the scales and heads of the compound inflorescence. One is the "entrerianus" mode characterized by hemispherical or spherical heads, and glossy scales with mostly acute apices. The "luzulae" mode is delineated by dull scales, pyramidal or cylindrical heads, and scales with obtuse apices. The "entrerianus" mode has been recognized at the specific and varietal levels, but its features merge so well with the "luzulae" form throughout the total geographic distribution that its separate recognition cannot be justified at this time.

A small, tufted plant from Argentina (*Pedersen 8224*) exhibits inflorescences that are intermediate between the "entrerianus" and "luzulae" modes of variation. It was collected on a clearing in a woodland where flooding often occurs. Such conditions undoubtedly affect the growth of these plants, as they are small in stature, and the inflorescences may be entirely or partially comprised of leafy branches. The proliferation of vegetative shoots in the compound inflorescence occurs only occasionally in this species.

Figure 9. Distribution of *Cyperus luzulae.*

Representative specimens:

UNITED STATES OF AMERICA: FLORIDA: SANTA ROSA CO: Pensacola, 6 Aug 1941, *Brinker 413* (MO).

MISSOURI: ST. LOUIS CO: St. Louis, 1 Aug 1891, *Eggert s.n.* (MO).

OKLAHOMA: CRAIG CO: Vinita, Indian Territory, 15 July 1880, *Letterman s.n.* (MO). CREEK CO: Sapulpa, Indian Territory, 22 July 1894, *Bush 615* (MICH).

TEXAS: CAMERON CO: 25 mi N of Brownsville, 16 June 1941, *Runyon 2761* (TEX).

MEXICO: TAMAULIPAS: Sierra de Tamaulipas, ca 40 km NNW of Aldama, Mpio. de Aldama, 28 July 1957, *Dressler 2048* (GH, MICH, MO). SAN LUIS POTOSI: Valles, 19 Aug 1937, *Fisher 37239* (F, GH, UC); 1.5 mi S of Tamazunchale, 9 July 1966, *Mears 454a* (TEX); Rascón, 19–22 June 1905, *Palmer 651* (GH, NY); wet places, Las Canoas, 19 Aug 1891, *Pringle 3806* (C, CAS, DUKE, F, GH, L, LL, LY, MICH, NY, TEX, UC); Villa de Reyes, 16 Nov 1956, *Rzedowski 8510* (ENCB); 2 km al SSE de Ojo de Agua, mpio. de Alaquines, 9 Feb 1959, *Rzedowski 9669* (ENCB); Las Canoas, mpio. de Cárdenas, 12 Sep 1967, *Rzedowski 24507* (ENCB). GUANAJUATO: Moro León, Feb 1898, *Duges 3* (GH). SINALOA: Culiacán, 27Aug–15 Sep 1891, *Palmer s.n.* (US); vicinity of Labradas, 20 Sep 1925, *Ferris & Mexia 5188* (CAS, DS). NAYARIT: 12 mi SE of Tepic, and nearly S of Cerro Sangangüey, 16–18 Aug 1959, *Feddema 590* (DUKE, MICH); Tepic, 5 Jan–6 Feb 1892, *Palmer 1540* (C, GH, MICH, US). MICHOACAN: Morelia, La Huerta, 15 Oct 1909, *Arsène s.n.* (C). ESTADO DE MEXICO: Dist. Tuxtepec, Chiltepec, 18 Aug 1941, *Martínez-Calderón 569* (MICH); Minatitlán, 30 June 1892, *Smith 799* (MO). VERACRUZ: region of San Andrés Tuxtla, near Los Mangos, 19 Aug 1953, *Dressler & Jones 118* (BM, F, GH, MICH, MO, NY, UC, US); Mpio. Jesús Carranza, between Jesús Carranza and Suchilapan, 25 Jan 1943, *Gilly 44* (MICH, MSC); Hacia Plan de las Hayas, km 739–761, 13 Aug 1969, *Lot 441* (F, GH); Córdoba, Aug 1936, *Matuda 302* (GH, MICH); Sanborn, 4 Mar 1910, *Orcutt 3059* (DS, MO); 3 km W of Nanchital, vicinity of Coatzacoalcos, 28 June 1960, *Rzedowski 23471* (ENCB); mpio. de Catemaco, Sontecomapan, 5 Aug 1965, *Rzedowski 20361* (DS, ENCB, LL, MICH); Ejido de Ixtacapa Chico 1 km SW of Campo Experimental de Hule, El Palmar, Zongolica, 13 Aug 1944, *Santos 3286* (MICH, TEX). OAXACA: Lacoba, 184_, *Galeotti 1866* (GH, MICH); 10 km S of Matías Romero, 27 July 1958, *King 855* (ENCB, LL, MICH, TEX, US); between Lacoba & Jacotepec, June 1892, *Liebmann s.n.* (C); Distrito Choapam Yaveo, 12 Mar 1938, *Mexia 9129* (B, GH, MO, US); Tehuantepec, 74 km N of Unión Hidalgo, 12 July 1958, *Williams, Jr. 15* (ENCB, MICH). CHIAPAS: Mpio. Ostuacán, Presa de Mal Paso, 21 July 1969, *Arreguín s.n.* (MICH); 10 mi N of Ocozocoautla along road to Mal Paso, Mpio. de Ocozocoaulta de Espinosa, 12 June 1965, *Breedlove 10358* (ENCB, NY); Mpio. de Tenejapa, paraje de Mahosik', 8 Aug 1966, *Breedlove 14841* (MICH, NY); between Huixtla and Tapachula, 2 Sep 1964, *Elias et al. 376* (A); Tapachula, 5 Aug 1935, *Fisher 35284* (MO, NY); 1 mi N of Acacoyagua, 1 June 1973, *Hansen & Nee 1629* (LL); Palenque ruins, 3 July 1969, *Marcks & Marcks 956* (LL); Palenque, 6–9 July 1939, *Matuda 3629* (GH, LL, MICH). TABASCO: near Alemán, 15 km NW of Cárdenas, 10 May 1963, *Barlow 26/12* (MICH); about 25 km W of Huimanguillo, 28 May 1963, *Barlow 30/135* (BM, GH), *30/137* (DS, UC); Emiliano Zapata, 26 May 1964, *Cota G. s.n.* (ENCB); Sebastián, 8 June 1889, *Rovirosa 498* (UC). YUCATAN: Uxmal, 20–21 July 1932, *Swallen 2588* (MICH, US).

GUATEMALA: ALTA VERAPAZ: vicinity of Cubilgüitz, 1 Mar 1942, *Steyermark 44364* (MICH); no locality, July 1907, *Türckheim 11128* (GH, L, LY, MO, NY, US). IZABAL: Gualán, 13 Jan 1905, *Deam 437* (GH, MICH, MO); Quebradas, 18 May 1919, *Pittier 8552* (US); Zapatillo, Lake Izabal, 21 June 1966, *Snedaker D-101* (F, GH); vicinity of Quiriguá, 15–31 May 1922, *Standley 23733* (GH, NY, US), 26–27 Apr 1939, *Standley 72488* (MICH).

BRITISH HONDURAS: BELIZE: Sibun River, 1 mi beyond Hattieville, 27 July 1971, *Dieckmann S. J. 314* (MO); Belize, 15 Mar 1933, *Lundell 1930* (MICH); 3 mi N of Sibun River, 9 mi S of Belize, 24 Aug 1936, *O'Neill 8989* (C, CAS, MICH, NY, UC). EL CAYO: San Antonio, 6 May 1931, *Bartlett 13073* (MICH); Prospecto-Maskalls Rd, Nov 1933, *Gentle 889* (B, C, MICH, MO, NY, UC); Augustine, Mountain Pine Ridge, by Rio Frio near Hydram, 13 Dec 1959, *Hunt 254* (BM, LL, US); Boomtown, 11 Sep 1936, *O'Neill 8988* (C, CAS, GH, MICH, US).

EL SALVADOR: SANTA ANA: no locality, 1924, *Calderón 2197* (US).

HONDURAS: ATLANTIDA: Lancetilla Valley, near Tela, 6 Dec 1927–20 Mar 1928, *Standley 53393* (US), *53737* (US); between Tela and Lancetilla, 13 July 1934, *Yuncker 4583* (MICH, MO); vicinity of La Ceiba, 12 July 1938, *Yuncker et al. 8364* (BM, GH, MICH, MO, NY, UC, US). EL PARAISO: near Ojo de Agua, 11 Aug 1946, *Williams & Molina R. 10294* (LL, MICH, UC). MORAZAN: Jicarito River, 24 June 1948, *Glassman 1739* (GH, NY); road between El Jicarito and El Pedregal, 13 Nov 1948, *Standley 14503* (F); SE of El Zamorano, base of Cerro Majicorán, 2 Aug 1949, *Standley 22125a* (F). SANTA BARBARA: San Pedro Sula, Apr 1887, *Thieme 5563* (US).

NICARAGUA: BLUEFIELDS: Finca Santa Rosa, ca 2.5 km ENE of Rama, Río Escondido, 5 Apr 1966, *Proctor et al. 27356* (GH, UC, US). BOACO: 1 km W of Boaca, 30 Dec 1968, *Moore 1459* (BM, F, GH, MO, UC). CHONTALES: 5 km SE of Juigalpa, 4 Jan 1969, *Atwood 1596* (BM, F, GH, MO, UC); 2 km S of Acoyapa, 4 Jan 1969, *Moore 1702* (F, MO). MATAGALPA: toward Tuma, 28 Feb 1971, *Svenson 4088* (MICH). RIO SAN JUAN: San Carlos, 10 Jan 1969, *Hamblett 2053* (BM, GH). RIVAS: 1 km N of Costa Rican boundary, 7 Jan 1969, *Moore 1824* (F, MO, UC). ZELAYA: Jackson Farm W of Bluefields, 3 Mar 1971, *Svenson 4143* (MICH).

COSTA RICA: ALAJUELA: about 7 km E of Ciudad Quesada, 17–18 May 1968, *Burger & Stolze 4949* (ENCB, GH). CARTAGO: Dept. Turrialba, grounds of Instituto Interamericano, 19 June 1947, *DeWolf 116* (NO); vicinity of Pejivalle, 7–8 Feb 1926, *Standley & Valerio 46860* (US).

GUANACASTE: 9.5 mi S of Nicaraguan border, near old road from Pena Blanca to La Cruz, 6 Aug 1946, *Morley 760* (UC). HEREDIA: La Selva, nr Puerto Viejo, 19 May 1972, *Opler 801* (F). LIMON: 2 km E of Siquirres, 20 Nov 1968, *Davidse & Pohl 1361* (MO); 6 mi inland from mouth of Estrella River, 1952, *Stork 4636* (MICH, UC). PUNTARENAS: Osa Peninsula, Rincón, 19 July 1968, *Davidse & Pohl 1146* (MO). SAN JOSE: vicinity of El General, July 1936, *Skutch 2736* (GH, MICH, NY, US).

PANAMA: BOCAS DEL TORO: Lagunas de Chiriquí, Nov–Dec 1885, *Hart 80* (US); junction of Ríos Changuinola and Tereba, 17–19 Dec 1966, *Lewis et al. 959* (GH); Chiriquicito to 5 mi S along Río Guarmo, 5–7 June 1967, *Lewis et al. 2007* (DUKE, UC). CANAL ZONE: Victoria Fill near Miraflores Locks, 6–14 Mar 1939, *Allen 1716* (GH, US); Colón, 7 May 1971, *Correa & Dressler 1744* (F); between Gorgona and Tabernilla, 15 Sep 1911, *Hitchcock 8106* (US); Barro Colorado Island, 1 Aug 1927, *Kenoyer 150* (US); around Porto Bello, 17–18 Jan 1911, *Pittier 2466* (US); around Culebra, 6 May 1911, *Pittier 3444* (US); Las Cascadas Plantation near summit, 2 Dec 1923, *Standley 25794* (US). COCLE: mountains above El Valle, 10 June 1967, *Stimson 5009* (DUKE). DARIEN: 4 mi up river from Santa Fe, 30 Sep 1961, *Duke 4164* (UC). HERRERA: vicinity of Las Minas, 22 Feb 1963, *Stern et al. 1800* (MICH, US). PROV. DE PANAMA: Mt. Vernon, Caladonia Harbor, 3 Apr 1939, *Elmore 67* (MICH, UC); Los Santos, Loma Prieta, Cerro Grande, 8 June 1967, *Lewis et al. 2237* (UC); Juan Díaz region, near Tapia River, 1–3 June 1923, *Maxon & Harvey 6757* (UC, US).

WEST INDIES: CUBA: PINAR DEL RIO: Mendoza, 16 Nov 1923, *Ekman 18084* (NY).

JAMAICA: ST. CATHERINE: no locality, 8 June 1915, *Harris 12064* (BM, CAS, MO, NY); near Salt Ponds, 27 Dec 1915, *Harris 12304* (BM, MO, NY, UC); Warwick Castle farm, 23 Aug 1961, *Powell 992* (BM).

DOMINICAN REPUBLIC: SAMANA: Samaná and vicinity, 13 Mar 1928, *Miller 1101* (CAS). DISTRITO NACIONAL: Santo Domingo, 9 Aug 1973, *Liogier 19897* (NY).

GUADELOUPE: Embouchure de la Grande Rivière de Deshaies, 21 Mar 1936, *Stehlé 2872* (UC).

DOMINICA: Portsmouth, between Prince Rupert Bay and Doublas Bay, 1 Aug 1938, *Hodge 251* (BM); near Pointe St. Michel, Nov 1881, *Eggers 535* (L, M); about 2.5 mi N of Pont Cassé, 16 July 1964, *Wilbur et al. 7555* (DUKE, F, NY, TEX).

MARTINIQUE: Saint Esprit Campfleue, 1880, *Duss 705a* (C, F, LY, NY).

ST. LUCIA: Quilesse, 23 May 1945, *Beard 1035* (MO); Port Castries, 1 Dec 1887, *Lee s.n.* (GH); SE of Piton Troumassée, 22–23 Apr 1959, *Proctor 17713* (BM).

ST. VINCENT: Charlotte Parish, on slope of Mt. Brisbane, 12 Apr 1962, *Cooley 8630* (DUKE).

GRENADA: Belvedere, 30 Oct–11 Dec 1957, *Proctor 16985* (BM).

TRINIDAD: Government Forest Reserve, 29 May 1925, *Broadway 5675* (F, MO, UC); St. Joseph Stock Farm, Pangola pasture, 10 July 1958, *Purseglove 6174* (L).

TOBAGO: Botanic Station, 5 Apr 1909, *Broadway 2988* (F, L, MO).

SOUTH AMERICA: COLOMBIA: ANTIOQUIA: Medellín, 21 Dec 1943, *Bernal 66* (MO). BOLIVAR: vicinity of Turbaco, 22 Nov 1926, *Killip & Smith 14461* (GH); Tierra Alta, Río Sines, 7–10 Mar 1918, *Pennell 4685* (GH). CHOCO: Bahía Solano, 4 Jan 1973, *Gentry & Forero 7190* (F). HUILA: Mpio. Santa María, 22 June 1967, *Plaxton s.n.* (MICH). SANTANDER: region del Sarare, hoya del Río Cubugón, junto a la Quebrada de Gibraltar, 15 Nov 1941, *Cuatrecasas 13212* (F); Puerto Wilches and vicinity, 28 Nov–2 Dec 1926, *Killip & Smith 14772* (GH). VALLE DEL CAUCA: La Trojita, 19 Feb–10 Mar 1944, *Cuatrecasas 16426* (F); Timba, 3 Mar 1937, *Sneidern 1124* (F, GH).

VENEZUELA: AMAZONAS: Río Orinoco, Boca del Vichada, 12–24 Jan 1930, *Holt & Gehriger 225* (B); Maroa, 10 Feb 1942, *Williams 14246* (F). BOLIVAR: Río Paragua, Guaiquinima, 14–15 Apr 1943, *Killip 37450* (BM, F). CARABOBO: Guaremales, road from Puerto Cabello to San Felipe, 25 July 1920, *Pittier 8891* (GH). MIRANDA: Parque Nacional de Guatopa, between Santa Teresa and Altagracia de Orituco, 14.5 km from Los Alpes, 23 Nov 1961, *Steyermark 89946* (B). TACHIRA: Colincho, San Félix, 16 May 1917, *Curran & Haman 1016* (GH). TERRITORIO DELTA AMACURO: no locality, 14 Nov 1960, *Steyermark 87529* (GH).

GUYANA: EAST DEMERARA: Georgetown, wild land in Botanic Garden, 24–26 Oct 1919, *Hitchcock 16543* (GH). ESSEQUIBO: Mora Landing, 21–23 Aug 1922, *de la Cruz 1837* (BM, F, GH, UC); Pomeroon River, 17–24 Dec 1922, *de la Cruz 3206* (GH, MO, UC); 1 mi S of Thern, Essequibo, 16 Apr 1956, *Irwin 969* (TEX). MAZARUNI-POTARO: 12–15 mi from Bartica, 28 Aug 1935, *Potter 5294* (GH).

SURINAM: NICKERIE: Wilhelmina Gebergte, Zuid River, Kayser Airstrip, 45 km above confluence with Lucie River, 27 Sep 1963, *Irwin et al. 57677* (GH, MICH, MO). PARAMARIBO: 3 km N of Paramaribo, 5 Apr 1944, *Maguire & Stahel 22730* (GH, MICH).

FRENCH GUIANA: CAYENNE: vicinity of Cayenne, 24 June 1921, *Broadway 566* (GH), 4 July 1921, *Broadway 646* (GH), no date, *Jelski s.n.* (GH).

ECUADOR: ESMERALDAS: Placa Rica, 6 Dec 1963, *Mexia 8408* (B, BM, F, GH, MO, UC). IMBABURA: Lita, 28 May 1949, Acosta *Solís 12549* (F). NAPO: Tena, 1 Oct 1939, *Asplund 8961* (CAS). PASTAZA: Mera, 30 Jan 1956, *Asplund 19143* (LL); near Puyo, 18–20 Feb 1935, *Mexia 6918* (B, F, GH, UC). PICHINCHA: wet places near Las Palmar Station, 2-5-58, *Prescott 1266* (MSC); Nanegalito, 15 July 1950, Acosta *Solís 17153* (UC).

PERU: HUANUCO: Bosque Nacional de Iparia, cerca del pueblo de Tournavisto, 2 Mar 1967, *Schunke 1705* (F). LORETO: about 40 km from Tingo María on highway to Pucallpa, 1 Nov 1949–5 Jan 1950, *Allard 20392* (UC); Pucallpa, 30 Oct 1947, *Fosberg 28889* (L); Caballo-Cocha on the Amazon River, Aug 1929, *Williams 2280* (GH). SAN MARTIN: NE of Tarapoto, 21–22 Aug 1937, *Belshaw 3293* (DUKE, F, GH, LL, MO, UC); Tarapoto, 11 Feb 1947, *Woytkowski 35054* (BM, F, MO, UC).

BOLIVIA: COCHABAMBA: 130 km NE of Cochabamba, 9 Mar 1939, *Eyerdam 24717* (UC). LA PAZ: Mapiri, Charopampa, Nov 1907, *Buchtien s.n.* (LY); Mapiri, Apr 1886, *Rusby 154* (MICH). PANDO: Trinidad, Aug 1944, *Cárdenas 3528* (GH). SANTA CRUZ: no locality, 27 Dec 1924, *Steinbach 6832* (B).

BRAZIL: AMAPA: Rio Araguari, 11 Sep 1961, *Rodrigues & Irvine 50857* (UC). AMAZONAS: Barcellos, Rio Negro, 9 Feb 1944, *Baldwin 3323* (F); Benjamin Constant, Alto Solimões, 7.9.62, *Duarte 6863* (M); Manaus, Jan 1932, *Lako 131* (B). CEARA: Grangeiro Taboleiros, Mar 1935, *Luetzelburg 24511* (F, MICH). MARANHAO: about 35 km S of Loreto, 23 Mar 1962, *Eiten & Eiten 3748* (L). MINAS GERAIS: Nr. Lagôa Pampulha, Municipio of Belo Horizonte, 8 Mar 1945, *Williams & Assis 6052* (GH); in Belo Horizonte, 11 June 1945, *Williams & Assis 7217* (GH). PARA: Belém, Mar–May 1929, *Dahlgren & Sella 602* (GH); mun. de Belém, about Lagôa Agua Preta, 29 June 1935, *Drouet 1936* (F, GH, MICH); Fazenda Camburupy, Ilha de Marajó, 19–20 June 1934, *Swallen 4948* (MICH). PERNAMBUCO: Tapera, 28 June 1933, *Pickel 2806* (DS, GH, MICH, MO). RIO DE JANEIRO: Rio de Janeiro, Serra de Carioca, 19 Nov 1928, *Smith 1345* (GH). RIO GRANDE DO SUL: Santa Maria, 10 Mar 1956, *Camargo 59326* (B); Pôrto Alegre, São Leopoldo, 7 Jan 1937, *Orth 692* (C, GH, UC); Guáiba, 24 Jan 1949, *Rambo S. J. 40127* (B); Pôrto Alegre, Jan 1899, *Reineck & Czermak 215* (M). SANTA CATARINA: Itajaí, 26 Nov 1961, *Klein & Barros 2.819* (B,L); Três Barras, S. Francisco do Sul, 21 Jan 1958, *Reitz & Klein 5.235* (B, UC). SAO PAULO: municipio de Moji-Guaçu, Fazenda Campininha, 8.5 km NNE of Padua Sales, 18 Apr 1961, *Eiten & Eiten 2672* (F).

PARAGUAY: GUAIRA: Villarica, 1930, *Jörgensen 22269* (GH). MISIONES: Santiago, 21 Apr 1961, *Pedersen 5038* (C) *5938* (L). SAN PEDRO: Carumbé, 29 Nov 1969, *Pedersen 9435* (C, L). DEPT. UNKNOWN: Central Paraguay, 1888–1890, *Morong 244* (BM, GH, UC); Ytororó, 11 Dec 1969, *Pedersen 9529* (C, L, UC), *9531* (C, L).

URUGUAY: TREINTA Y TRES: Vergara, M Dec 1932, *Herter 1617a* (F).

ARGENTINA: BUENOS AIRES: San Fernando, 11 Apr 1969, *Pedersen 9097* (C, L, UC). CHACO: Machagay, 8 May 1945, *Meyer 9865* (F). CORDOBA: Alto Alegre, Jan 1941, *Ousset 22* (GH). CORRIENTES: Paso de los Libres, Paso Troncón, 16 Dec 1946, *Huidobro 3765* (CAS); camino a San Carlos, 11–13 Feb 1971, *Krapovickas et al. 18108* (LL, MO, UC); Mburucuyá, Santa Teresa, 14 Feb 1951, *Pedersen 1015* (C); Depto. Empedrado, Estancia "La Yela," 25 Nov 1957, *Pedersen 4668* (C, MO, UC); Depto. Mburucuyá, Santa María, 18 Jan 1960, *Pedersen 5333* (A, C, UC). ENTRE RIOS: Colonia Elía, 2 Feb 1967, *Pedersen 8031* (C); Depto. Federación, Estancia "Buena Esperanza," 28 Mar 1967, *Pedersen 8155* (C, L, UC), 6 Apr 1971, *Pedersen 9810* (C); 12 km E of Ceibas, 8 Feb 1973, *Pedersen 10294* (C). FORMOSA: Depto. La Paz, en divisío de la Ruta 126 a Bovril, 16 Mar 1962, *Burkart et al. 23.282* (BM); Depto. Pirané, sur de Casco Cué, 20 Feb 1946, *Morel 977* (CAS); in regione inferioris fluminis Pilcomayo, May 1906, *Rojas 162* (BM). JUJUY: 17 km W of San Pedro de Jujuy, 13 Oct 1938, *Eyerdam & Beetle 22557* (UC). MISIONES: Santa Ana, 7 Jan 1913, *Rodriguez 700* (GH). SALTA: Depto. Cerrillos, 2 Nov 1941, *Meyer 3584* (GH). TUCUMAN: no locality, Dec 1872–Jan 1873, *Lorentz & Hieronymus s.n.* (B).

Cyperus ochraceus Vahl, Enum. Pl. 2: 325. 1806. Type: St. Croix, *West 15* (C!, holotype). Figure 5 (A–D).

Cyperus ochraceus Vahl var. *excelsior* Kükenthal, Pflanzenreich IV. 20 (Heft 101): 182. 1936. Type: Bolivia, Villa Montes, Prov. Tarija, 1911, *K. Pflanz 651* (B!, lectotype); Puerto Rico, *P. E. Benzon s.n.* (not A. Benzon as cited in *Das Pflanzenreich*) (C!, paratype).

Cyperus ochraceus Vahl var. *minor* Kükenthal, Pflanzenreich IV. 20 (Heft 101): 182. 1936. Type: Puerto Rico, "bei Guanica am Rand einer Lagune," *Sintenis 3839* (B!, holotype).

Tufted perennial up to 50 (–80) cm tall; stems erect, stiff to flexuous, round or obtusely triquetrous, smooth, green, light green, or stramineous, 1–2.5 mm wide distally, 1–5 mm wide at the base; leaves 3–11, mostly shorter than the stem but some exceeding the compound inflorescence, 14–30 cm long; leaf sheath 2–10 cm

long, brown, or stramineous, with red glands adaxially (especially on the membranous portions), without transverse septa between the red veins, sometimes persistent and becoming dark brown and partially fibrous the second year; leaf blade 1.5–4 mm wide at mid-length, usually flat, light to dark green, attenuate at apex; involucral bracts 4–8, foliaceous and spreading, 10–33 cm long, 2–6 mm wide, sheathless or with a sheath less than 2 mm long, usually flat, without transverse septa between the veins, apically attenuate; compound inflorescence 2–10 (–20) cm long; primary peduncles up to 13 or absent, 1.5–9 (–16) cm long, 0.5–0.8 mm wide, round, smooth, stiff to flexuous; secondary peduncles absent or 1–6, up to 2.5 cm long, ca 0.5 mm wide, straight; heads hemispherical, the primary ones 17–30 mm wide and with (4–) 10–26 spikelets, the secondary ones 12–20 mm wide and with 4–15 (–25) spikelets; bracteoles ovate, 2–2.5 mm long, 5–9-veined, coriaceous or membranous, apically attenuate; prophyll of spikelet 0.5–1.5 mm long, membranous, 3-veined; spikelets oblong, (5–) 7–10 (–35) mm long, 2–3 mm wide, apically acute, with (10–) 18–26 (–88) scales; rachilla 0.3–0.4 mm wide, ca 0.15 mm thick, straight or slightly arched, green to reddish brown, the transverse scale scars 0.5–0.8 mm apart on each side; scale angles (45°–) 60°–90°; scales (1.2–) 1.5–2 mm long, 1.2–2 mm wide, or 0.6–0.7 mm wide and either triangular or lunate in lateral view, adaxially with red to reddish brown glandular, longitudinal striations, apically acute and straight or slightly incurved, distinctly bicarinate basally, the proximal abaxial groove between the two keels 0.6–1.5 mm long; medial part of scale subcartilaginous or chartaceous, greenish brown to dull white, barely scabrellate distally; sides of scale membranous or chartaceous and reticulate with large cells, usually becoming glossy with maturation, golden brown or dark yellow, the margins revolute on the upper two-thirds to three-fourths of the scale, basally attached to the rachilla for 0.4 mm leaving ca 0.2 mm free on each side; stamen solitary, 1.5–2 mm long, the filament 1.2–1.5 mm long, the anther 0.8–1.2 mm long; pollen 25–30 μ in diameter; style 0.6–1.2 mm long, the stigmatic branches 0.3–0.6 mm long; achene filling two-thirds to three-fourths of the scale, bilaterally symmetric or slightly asymmetric, black or blackish brown, broadly trigonous, obtusely angled, about two times longer than wide, 1–1.5 mm long (total length), the stipitate base less than 0.1 mm long, the body 0.9–1.2 mm long, and the slender apical beak as much as 0.5 mm long; achenial surfaces equal in width, 0.4–0.5 (–0.6) mm wide, narrowly ovate, generally convex or planar, or the abaxial surfaces planar on the lower one-half and convex on the upper one-half.

Distribution. Known from the Greater and Lesser Antilles and from Louisiana and Texas south through Mexico and Central America, and in Colombia, Venezuela, and Argentina. In sandy, silty, or clayey soils of ditches, fields, pastures, swamps, lava flows, cleared depressions of pine-oak forests or subtropical forests, and near lakes or streams, from sea level to 2350 meters in elevation (Fig. 10).

Discussion. The strong reflexion of the scales from the rachilla provides one of the most distinctive features of *C. ochraceus.* Other distinguishing characters are oblong spikelets, scales with straight or subtly incurved apices, and broadly trigonous, obtusely angled achenes. The achenes are usually bilaterally symmetric but may be asymmetric when one of the abaxial surfaces is planar proximally and convex distally, thus creating a hump on the upper part of one of the abaxial surfaces.

The spikelets of *C. ochraceus* usually appear interrupted, a condition caused by the long internodes of the rachilla. The scales are widest just above the base, and only about one-half of each side is attached basally. The distinctive free parts, ca 0.2 mm on each side, tend to give the appearance of flaps or auricles. The scales may appear roughened, with reticulate cells, or smooth and glossy, but this variation is not useful to denote infraspecific ranks; often both of these conditions are visible on one spikelet. One specimen from Uvalde County, Texas (*Correll & Correll 26159*), has large

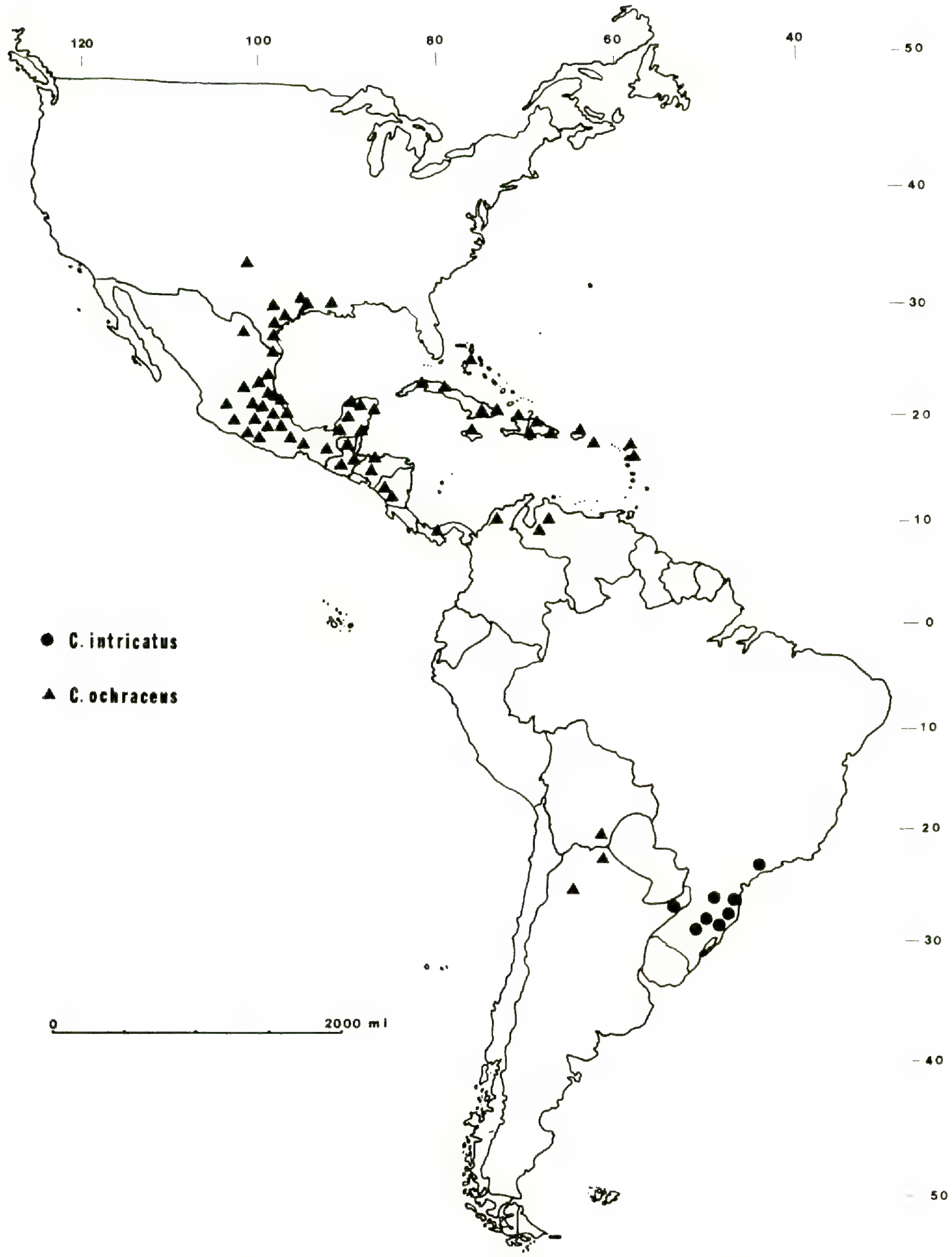

Figure 10. Distribution of *Cyperus intricatus* and *C. ochraceus*.

spikelets, 24–35 mm long, consisting of 60–88 scales. Other than for the increased size of the spikelets, the specimen is typical *C. ochraceus*. Larger than average spikelets, 25–30 mm long, are also found on a collection from Provincia Salta, Argentina (*Beetle 22637*).

The stems of *C. ochraceus* are about the same size as those of *C. luzulae* but smaller than those of *C. eragrostis*, *C. distinctus*, and *C. virens*. The lack of transverse

septa and the nodulose condition of the foliage leaves and involucral bracts serve to separate *C. ochraceus* from *C. virens* and *C. eragrostis,* and sometimes from *C. acuminatus* and *C. luzulae.* The achenes of *C. ochraceus* may be confused with those of *C. eragrostis* but are different in that they are obtusely rather than acutely angled, planar or convex rather than concave, and ovate rather than obovate.

Representative specimens:

UNITED STATES OF AMERICA: LOUISIANA: IBERIA PARISH: N side of New Iberia, 10 July 1969, *Thieret 31604* (DUKE, LL).

TEXAS: BEXAR CO: San Antonio, 15 June 1911, *Clemens & Clemens 402* (MICH), 7 July 1911, *Clemens & Clemens 404* (UC), 18 June 1941, *Metz s.n.* (UC). BRAZORIA CO: 3 mi W of Angleton, Oyster Creek, 2 July 1963, *Correll et al. 28175* (LL); Cocklebur Slough on San Bernard Refuge, 11 Aug 1969, *Fleetwood 9530* (TEX); Angleton, 6 July 1972, *Fleetwood 10098* (MO). CALHOUN CO: 15¼ mi SW of Port Lavaca, 24 Nov 1945, *Cory 51146* (LL). CAMERON CO: Brownsville, 21 Apr 1933, *Clover 981* (TEX), 22 June 1922, *Tharp 1136* (TEX); about 2 mi S of San Benito, 13 July 1957, *Correll & Johnston 17920* (LL, UC); 2 mi NW of Olmito, 1 June 1938, *Runyon 1823* (MICH, TEX, UC). FORT BEND CO: near Thompsons, 5 Oct 1965, *Correll 31864* (LL). HARRIS CO: Houston, 10 July 1937, *Fisher s.n.* (C, CAS, DS, DUKE, MICH, TEX, UC). HIDALGO CO: Santa Ana National Wildlife Refuge, at edge of East Lake, 5 June 1970, *Correll & Correll 38865* (LL); about West Lake, Santa Ana Wildlife Refuge, 12 June 1963, *Correll & Wasshausen 27686* (LL, UC); La Joya Lake, 8 June 1941, *Runyon 2757* (TEX, UC); 10 mi W of Santa Maria, 25 May 1946, *Walcott & Barkley 16 T 361* (TEX, UC). JACKSON CO: Lavaca River, 27 Aug 1941, *Tharp s.n.* (MO, TEX). JIM WELLS CO: Along Old Alice Road, near Alice, 1 Nov 1942, *Freeborn & Freeborn 193* (BM, TEX). KARNES CO: 1 mi SW of junction of Texas hwy. 123 and Farm-to-Market Road 81, Panna Maria, 12 June 1953, *Johnson 1235* (TEX). KLEBERG CO: 4 mi NE of Kingsville, 28 Nov 1945, *Cory 51288* (LL). LIBERTY CO: Trinity River bottomland about 1 mi E of Dayton, 25 Oct 1967, *Correll 35279* (LL). MATAGORDA CO: Bay City, 7 Aug 1918, *Fisher s.n.* (MICH, MO, UC). MAVERICK CO: 8 mi S of Eagle Pass, 22 Sep 1962, *Anda et al. 8363* (TEX). NUECES CO: SE of Corpus Christi, 21 Aug 1963, *Correll & Correll 28502* (LL, UC); about 5 mi S of Banquete, 30 Nov 1954, *Johnston 542270* (LL, TEX); Agua Dulce Creek bottom near highway 44, 29 Nov 1954, *Johnston 542313* (TEX). SAN PATRICIO CO: 6 mi NW of Taft, 22 Nov 1962, *Sanchez 49* (TEX); along shores of lake in Corpus Christi Lake State Park, 13 June 1947, *Webster & Rowell 7083* (ENCB, TEX); Welder Wildlife Refuge, 28 Aug 1957, *Williges Sn 4* (TEX). STARR CO: U.S. Highway 83–below Falcon Dam, 27 Oct 1962, *Gongora et al. 8459* (LL, TEX). SWISHER CO: Tule Lake near Tulia, 1926, *Tharp s.n.* (MICH). UVALDE CO: about 1 mi N of Uvalde, along route 83, 2 Oct 1969, *Correll 38063* (LL); Blewett, 2 Oct 1962, *Correll & Correll 26159* (LL); Memorial Park, Uvalde, 15 Aug 1937, *Cory 23832* (GH); 12 mi SE of Uvalde, 15 Aug 1937, *Cory 23833* (GH); Uvalde, 14 Oct 1916, *Palmer 11033* (BISH, DS); near Uvalde, springy banks of Nueces River, 24 Sep 1918, *Palmer 14487* (B, MO). WEBB CO: Lake Casa Blanca, 6 mi E of Laredo, 10 Oct 1961, *Pena, Jr. 33-d* (TEX), 25 Nov 1962, *Ramirez 5* (TEX). WILLACY CO: 2¼ mi N of Raymondville, 2 Dec 1945, *Cory 51466* (LL); Raymondville, 18 Oct 1938, *Runyon 1920* (TEX, UC).

MEXICO: COAHUILA: Sabinas River, Muzquiz, 11 July 1936, *Marsh 401* (TEX); Múzquiz Swamp, 15 Sep 1936, *Marsh 889* (GH, TEX). NUEVO LEON: Monterrey, 16 June 1930, *Arsène s.n.* (B), July 1911, *Arsène 6122* (US), 12 Aug 1930, *Fisher 6* (US); Ojo de Agua Nogolar, 5 mi N of Monterrey, 18 Aug 1944, *Hernández Corzo & Barkley 14590* (TEX); Monterrey Country Club, 10 Oct 1937, *Kenoyer 321* (F). TAMAULIPAS: Sierra de San Carlos near Tangue, vicinity of El Mulato, 16 Aug 1930, *BArtlett 10975* (F, MICH); 3 mi SW of El Canelo, 9 Feb 1960, *Crutchfield & Johnston 5080* (MICH, TEX); 10 mi E of Ciudad Mante, 31 Aug 1948, *Kenoyer & Crum 3666* (MICH); ca 4–5 mi S of Ciudad Mante, 18 Feb 1961, *King 3812* (F, MICH, TEX, UC, US); N of Tampico near Barranco, 3/8/39, *LeSueur 16* (TEX); 16.1 mi N of Cd. Victoria on Hwy. 101 towards Matamoros, 11 July 1966, *Mears 524a* (TEX); 15 km al W de Tampico 4 Feb 1968, *Saucedo s.n.* (ENCB). SAN LUIS POTOSI: Mpio. El Pujal, Valley of Río Tampaón, 19 July 1939, *Chase 7499* (GH, MICH); Micos, 19 July 1933, *Fisher 331* (GH, US); 12 mi E of Valles, 9-5-48, *Kenoyer & Crum 3871* (MICH); wet places, Las Canoas, 17 June 1891, *Pringle 3724* (ENCB, F, GH, M, MICH, UC, US); 3 km al W de Huichihuayán, 3 May 1959, *Rzedowski 10439* (ENCB); Las Canoas, Mpio. de Cárdenas, 12 Sep 1967, *Rzedowski 24537* (ENCB); Mpio. de Cárdenas, Poza Azul, cerca de Canoas, 12–15 Sep 1967, *Rzedowski 24773* (DS, ENCB). JALISCO: 1 mi W of Ayo el Chico, 23 Aug 1958, *McVaugh 17221* (ENCB, MICH). MICHOACAN: 11–13 km WSW of Apatzingán, along the road to Dos Aguas and Aguililla, *Dieterle 4256* (MICH); Tancítaro Region, municipality Apatzingán, 7 Aug 1941, *Leavenworth & Hoogstraal 1357* (F, GH, MICH). GUERRERO: 2 mi S of Acahuizotla, 16 July 1952, *Rowell, Jr. 3085* (MICH); cerca de Mazatlán, Mpio. de Chilpancingo, 9 Oct 1969, *Rzedowski 26885* (ENCB). ESTADO DE MEXICO: nr.

México, June 1907, *Arsène s.n.* (L); Tonatico, Piedras Negras, 15 Nov 1953, *Matuda et al. 30099* (DS); 1 mi W of Progreso, 14 Aug 1950, *Pipes 142* (MICH). MORELOS: 20 km NE of Cuautla, *Boyd 58* (MICH). HIDALGO: 4 km SE of San Bartolo Tutotepec, 3 June 1972, *Leyra 639* (ENCB); 4 km al W de Tolcayuca, 23 Aug 1970, *Quezada 1123* (ENCB). PUEBLA: Mpio. de Agua Fría, 20 May 1969, *Puig 4671* (ENCB). VERACRUZ: 2 km al N de Casitas, cerca de Nautla, 21 Apr 1968, *Gutiérrez 242* (ENCB); 7 km al S de Tecolutla, Riachuelos, 5 May 1968, *Gutiérrez 301* (DS, ENCB, MICH); El Palmar, Zongolica, 23 km N of Campo Exp. de Hule, 7 May 1944, *Santos 2949* (MICH). OAXACA: Cuicatlán, 2 Dec 1897, *Conzatti & Gonzalez 657* (GH, US); 2 km W of Juchitán on Pan-Am hwy. to Tehuantepec, 4 July 1969, *Marcks & Marcks 986* (LL). CHIAPAS: Amatengo del Valle, 27 July 1966, *Breedlove 14677* (ENCB, LL, MICH, NY). TABASCO: Tenosique, Bosa Cerro, 1–5 July 1939, *Matuda 3578* (GH, MICH). CAMPECHE: Tuxpeña, 11 Oct 1931, *Lundell 803* (DS, F, GH, MICH, UC, US); Champotón, 7–15 July 1932, *Steere 1970* (MICH), *1973* (MICH). YUCATAN: Izamal, no date, *Gaumer 1028* (GH, UC); Progreso, 11–15 Aug 1932, *Swallen 2963* (MICH, US). QUINTANA ROO: Caleta, Cozumel, 18 Feb 1899, *Millspaugh 1519* (F); San Miguel, Cozumel Island, 6–8 Aug 1932, *Swallen 2093* (MICH), *2906½* (MICH, US).

BRITISH HONDURAS: Maskall, northern river, Dec 1933, *Gentle 1018* (CAS, GH, MICH, UC); San Andrés, Corozal, 6 July 1933, *Lundell & Gentle 4810* (B, CAS, DS, L, MICH, TEX, UC, US, WTU); along New River, Orange Walk, 8 Sep 1936, *O'Neill 8980* (C, CAS, DS, DUKE, F, GH, MICH, TEX, UC, US).

GUATEMALA: HUEHUETENANGO: Ciénaga de Lagartero, below Miramar, 29 Aug 1942, *Steyermark 51547* (F). IZABAL: about 15 km N of Quiriguá, 28 May 1922, *Standley 24643* (GH, US). PETEN: Ruinas Plaza Mayor Tikal, 16 Nov 1965, *Molina R. 15828* (F).

HONDURAS: ATLANTIDA: Lancetilla Valley, near Tela, 6 Dec–20 Mar 1928, *Standley 55757, 55764* (both US). COMAYAGUA: vicinity of Comayagua, 12–23 Mar 1947, *Standley & Chacón 5996* (F). CORTES: vicinity of La Lima, 11–20 Apr 1947, *Standley & Chacón 7235* (F).

NICARAGUA: MANAGUA: Tule region of Managua, vicinity of Managua, July 1932, *Garnier 787* (US); Managua, no date, *Garnier 4450* (GH). RIVAS: puente las Cabezas, route 2, NW of Belén, 7 Jan 1969, *Moore 1928* (BM, GH).

PANAMA: DARIEN: 3 mi N of Santa Fe, 15 July 1966, *Tuson et al. 4613* (GH).

BAHAMAS: NEW PROVIDENCE: Nassau, 2 May 1903, *Curtiss 210* (L, LY), 15 Jan 1890, *Northrop & Northrop 144* (F).

CUBA: ORIENTE: Renté, Santiago, June 1943, *Clemente 2881* (GH); road from Mayarí to Cueto, 19 Oct 1941, *Morton 3307* (UC, US). SANTA CLARA: Guantánamo Bay, 17–30 Mar 1909, *Britton 2072* (US); 1½ mi W of Manacas, Aug 1940, *Hodge & Howard 4258* (A, DUKE); Cienfuegos, Soledad, 21 Aug 1931, *Jack 8337* (GH, US); vicinity of Baracoa, 18 Feb–Mar 1910, *Shafer 3948* (F, US). SANTIAGO: vicinity of San Luis, 15–18 Feb 1902, *Pollard & Palmer 309* (GH, MO, UC, US).

JAMAICA: HANOVER PARISH: 3½ mi W of Lucea, 9 Sep 1960, *Adams 8036* (BM); Eton, Hanover, 24 Jan 1918, *Harris 12872* (CAS, F, GH, MO, UC). ST. ANN PARISH: Salem, 17 Apr 1960, *Adams 6879* (BM, MO); Roaring River, Mar 1926, *Davis s.n.* (MICH), 7 Mar 1936, *Hunnewell & Griscom 14121* (GH). ST. CATHERINE PARISH: Charlemont area NE of Ewarton, 23 Jan 1958, *Howard & Proctor 15198* (A); ca 1 mi W of Spanish Town, 15 Nov 1958, *Proctor 18344* (BM). ST. JAMES PARISH: near Bickersteth, 1 mi SE of Montpelier, 7 July 1957, *Proctor 16459* (BM, MO). ST. MARY PARISH: around Green Castle, 5 July 1963, *Crosby et al. 492* (DUKE). ST. THOMAS PARISH: near White Horses, 2 Jan 1958, *Yuncker 17897* (BM, MICH). WESTMORELAND PARISH: 1 mi SE of Georges Plain house, 23 July 1966, *Proctor 27566* (BM, LL).

HAITI: NORD-OUEST: vicinity of Basse Terre, Tortue Island, 21–29 Mar 1929, *Leonard & Leonard 13985* (GH, MICH, US); vicinity of Louis du Nord, 20 Mar–7 Apr 1929, *Leonard & Leonard 14101* (MO, NY, UC, US). NORD: between Cap-Haïtien and Le Borgne, "La Plaine de Port Margot," 19–24 June 1941, *Bartlett 17457* (MICH, NY, US). OUEST: Port-au-Prince, Massif de la Selle, Mariani, 17 Oct 1924, *Ekman H 2170* (US); vicinity of Pétionville, 15–28 June 1920, *Leonard 5085* (NY, US). SUD: between Anse d'Hainault and Dame Marie, southern peninsula, 8 July 1941, *Bartlett 17517* (GH, MICH, US).

DOMINICAN REPUBLIC: DISTRITO NACIONAL: vicinity of Ciudad Trujillo, 2 Oct 1947, *Allard 18505* (US); Santo Domingo, Llano Castero, shore of Río Ozama, 30 Apr 1929, *Ekman 12349* (F, GH, NY), 14 May 1929, *Ekman 12471* (A, LL, MICH, UC, US). PUERTO PLATA: Cespitosa, 7 Dec 1952, *Jiménez 2510* (US). SAMANA: vicinity of Sánchez, 29 Nov–12 Dec 1920, *Abbott 15a* (US). SANTIAGO: vicinity of Santiago, 11 Jan 1946, *Allard 14583* (GH, US); Monte Colorado near La Placeta, 28 Sep 1958, *Jiménez 3812* (US).

PUERTO RICO: BAYAMON: Bayamón, 1 Feb 1899, *Heller & Heller 409* (C, US); pastures near Bayamón, 2 Nov 1963, *Liogier 10339* (GH, US). MAYAGUEZ: Guánica, 2 Feb 1886, *Sintenis 3605* (LY, US), 17 Feb 1886, *Sintenis 3817* (GH, M). PONCE: 2 mi W of Ponce, 28 Nov 1902, *Heller 6145* (GH, MO, US).

ST. CROIX: Orange Grove, 4 Mar 1896, *Ricksecker 308* (F, GH, MO, NY, UC); River Estate, 4 Oct 1923, *Thompson 378* (GH).

ANTIGUA: Sandersons, 21 Feb 1938, *Box 1390* (F, UC).

GUADELOUPE: no locality, 1895, *Duss 3654* (C, F, GH, MO, NY).

MARTINIQUE: dans les rues peu frequentés de Sainte-Pierre, *Duss 700a* (NY).

SOUTH AMERICA: COLOMBIA: BOLIVAR: vicinity of Turbaco, 6–22 Nov 1926, *Killip & Smith 14457* (GH).

VENEZUELA: MERIDA: Brecenio Hacienda, Mar 1931, *Reed 664* (B), 12 Feb 1931, *Reed 615* (MICH). MIRANDA: Santa Lucía, 6–8 Mar 1943, *Killip & Tomayo 37011* (F).

BRAZIL: MINAS GERAIS: Planalto do Brasil, 15 km N of Montalvania, 18 Mar 1972, *Anderson et al. 37168* (NY).

ARGENTINA: SALTA: Depto. Orán, La Cantero camino de Orán Tobacal, 9 July 1946, *Borsini 521* (F); Depto. Orán, Tartagal Río, 25 km W of Manuela Pedraza, 26 Oct 1938, *Eyerdam & Beetle 22637* (MO, UC).

Cyperus pseudovegetus Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.] : 24. 1854.

Tufted perennial; stems erect, sometimes flexuous, roundly triquetrous, smooth, grayish green, green, or stramineous, 1–3 mm wide distally, 2–7 mm wide at base; leaves 3–12, one-half as long as to equalling the stem; leaf sheath reddish brown, often with inconspicuous transverse septa between the veins, faintly nodulose, sometimes persistent and becoming dull brown and somewhat fibrous the second year; leaf blade conduplicate or flat, grayish green, green, or stramineous, obtuse to attenuate at apex; involucral bracts usually foliaceous and spreading, sheathless or with a sheath less than 1 mm long, conduplicate or flat, grayish green, green, or stramineous, with inconspicuous transverse septa between the veins, faintly nodulose, apically acute to attenuate; primary peduncles triquetrous or round, smooth, rigid to flexuous; secondary peduncles straight; heads hemispherical or infrequently pyramidal; bracteoles ovate, 2–2.5 (–3) mm long, 3–5-veined, chartaceous, apically attenuate to mucronate; prophyll of spikelet 0.5 (–1) mm long, membranous, 5-veined; spikelets usually broadly ovate, apically obtuse to rounded; rachilla 0.15–0.3 mm wide, ca 0.1 mm thick, slightly arched, dark reddish brown, the transverse scale scars 0.4–0.5 mm apart on each side; scales 0.2–0.3 mm wide and usually falcate in lateral view, adaxially with red glandular, longitudinal striations, distinctly bicarinate basally; medial part of scale subcartilaginous to chartaceous, green to stramineous, barely scabrellate distally; sides of scale membranous and reticulate with large cells, becoming glossy and papyraceous at maturity, the margins hyaline and revolute on the upper one-fourth to one-third of the scale, basally attached to the rachilla for ca 0.2 mm; stamen solitary; pollen 25–30 μ in diameter; achene dark brown or dark reddish brown, narrowly trigonous, obtusely angled, 1.0–1.5 mm long (total length), the stipitate base less than 0.1 mm long, the slender apical beak 0.1–0.2 mm long; achenial surfaces 0.2–0.3 mm wide, elliptic or narrowly ovate, planar.

Discussion. Distinguishing features of *C. pseudovegetus* are its round stems, usually hemispherical heads, broadly ovate spikelets, falcate scales, and long, narrow, stipitate achenes four to seven times longer than wide. The scales are 2–3 mm long, which is longer than in most of the related taxa, the exceptions being *C. virens* and *C. intricatus.* As in *C. distinctus,* the lateral sides of the scale are narrow, taper only slightly to the base, and do not overlap with others on the same side of the rachilla. Close examination of the scales and achenes will successfully differentiate *C. pseudovegetus* from those allies with which it may be sympatric, mainly *C. virens, C. distinctus,* and *C. luzulae.*

The two allopatric varieties of *C. pseudovegetus* are easily recognized. Variety *pseudovegetus* is limited to the eastern half of the United States and has smaller stems, fewer involucral bracts, and a more diminutive habit than variety *megalanthus* which is found from central Mexico south to Guatemala. Although the typical inflorescence in

Figure 11. A–D. *Cyperus pseudovegetus* var. *pseudovegetus*; A, inflorescence, × ½ (based on *Fisher 372*); B–D (based on *Demaree 3437*); B, spikelet, × 5; C, scale, × 17.5; D, achene, × 17.5. E–H. *Cyperus pseudovegetus* var. *megalanthus* (based on *Lundell 2658*); E, inflorescence, × ½; F, spikelet, × 5; G, scale, × 17.5; H, achene, × 17.5. I–K. *Cyperus distinctus* (based on *A. S. Hitchcock 385*); I, spikelet, × 5; J, scale, × 17.5; K, achene, × 17.5.

var. *megalanthus* shows the conversion of normal spikelets to a proliferation of leafy vegetative shoots indicating an abnormal reproductive system, some fruits are produced by the plants. The taxonomic delimitation of var. *megalanthus* is supported by its morphological distinction from related taxa, and at least partial sexual reproduction in widely separated localities.

Cyperus pseudovegetus Steudel var. **pseudovegetus**. Type: in Carolina australi, *M. Curtis s.n.* (K!, presumably an isotype). Figure 11 (A–D).

Cyperus arenicola Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.]: 51. 1854. Type: Texas, auf sandhügeln in der Colonie Rusk County, Aug. V, *Vincent 26* (B!, presumably an isotype).

Cyperus cyrtolepis Torrey & Hooker var. *arenicola* (Steudel) Böckeler, Linnaea 35: 558. 1868.

Cyperus luzulae Rottbøll var. *umbellulatus* Britton, Bull. Torrey Bot. Club 13: 208. 1886. Type: Delaware, Townsend, Aug 1874, *Canby s.n.* (NY!, lectotype); no locality specified, *Lindheimer 201* (K! in part, paratype).

Cyperus calcaratus Nees ex S. Watson & Coulter, in A. Gray Man. Bot. Northern U.S., ed. 6. 570. 1890. Type: Texas, of unknown origin (GH!, presumably a fragment of holotype).

Cyperus pseudovegetus Steudel var. *arenicola* (Steudel) Kükenthal, Pflanzenreich IV. 20 (Heft 101): 176. 1936.

Cyperus virens Michaux var. *arenicola* (Steudel) Shinners, Field & Lab. 22: 30. 1954.

Plant up to 60 (–80) cm tall; leaves 3–8 (12), (12–) 20–58 cm long; leaf sheath 2–12 cm long; leaf blade (1–) 4–6 (–8) mm wide at mid-length, usually conduplicate; involucral bracts (3–) 4–8, up to 50 cm long, up to 5 mm wide; compound inflorescence 1.5–9 cm long; primary peduncles 3–10, 0.5–5 cm long, 0.4–0.6 mm wide; secondary peduncles absent or 1–6, up to 7 mm long and 0.3–0.5 mm wide; primary heads 7–15 mm long and 5–15 mm wide, with (15–) 35–80 spikelets; secondary heads 5–11 mm long and 5–10 mm wide, with (12–) 20–60 spikelets; spikelets 2–5 mm long, 1.5–3 mm wide, with (4–) 10–22 (–26) scales; scale angles 20°–30° (or lowermost scales declined 45°); scales 1.5–2.2 (–2.5) mm long, 0.5–1 mm wide, apically acute to cuspidate and slightly excurved, the proximal abaxial groove between the two keels 0.8–1 mm long; sides of scale yellowish brown or reddish brown; stamen 1.8–2.5 mm long, the filament 1.5–2 mm long, the anther 0.5–0.8 mm long; style 0.8–1 mm long, the stigmatic branches 0.3–0.5 mm long; achene filling about three-fourths of the scale, bilaterally or radially symmetric, five to seven times longer than wide, 1–1.3 (–1.5) mm long (total length), the body 0.9–1.3 mm long; achenial surfaces equal in width.

Distribution. From New Jersey south to Florida, and west to Illinois, Oklahoma, and Texas. Habitats include sandy prairies, swampy thickets, marshes, chert bottoms, wet depressions in fields or floodplain forests, and drainage ditches with sandy loam soils, from sea level to 200 meters in elevation (Fig. 12).

Discussion. The four to eight involucral bracts and the achenes five to seven times longer than wide are the two characters that most readily separate this variety from var. *megalanthus.* The size and shape of the three achenial surfaces are similar to each other, but the whole achene may be curved slightly toward the adaxial surface, forming a bilaterally symmetric shape. The size and number of heads may vary, but the extent of this variation is of no apparent taxonomic significance.

When spikelets are infected with a smut, *Testicularia cyperi*, they become distorted. This condition was found on a specimen of var. *pseudovegetus* from Oklahoma (*Mitchell 3815*).

Representative specimens:

UNITED STATES OF AMERICA: NEW JERSEY: SALEM CO: Riddleton Station, Salem, 16 Sep 1894, *Lippincott 128* (GH).

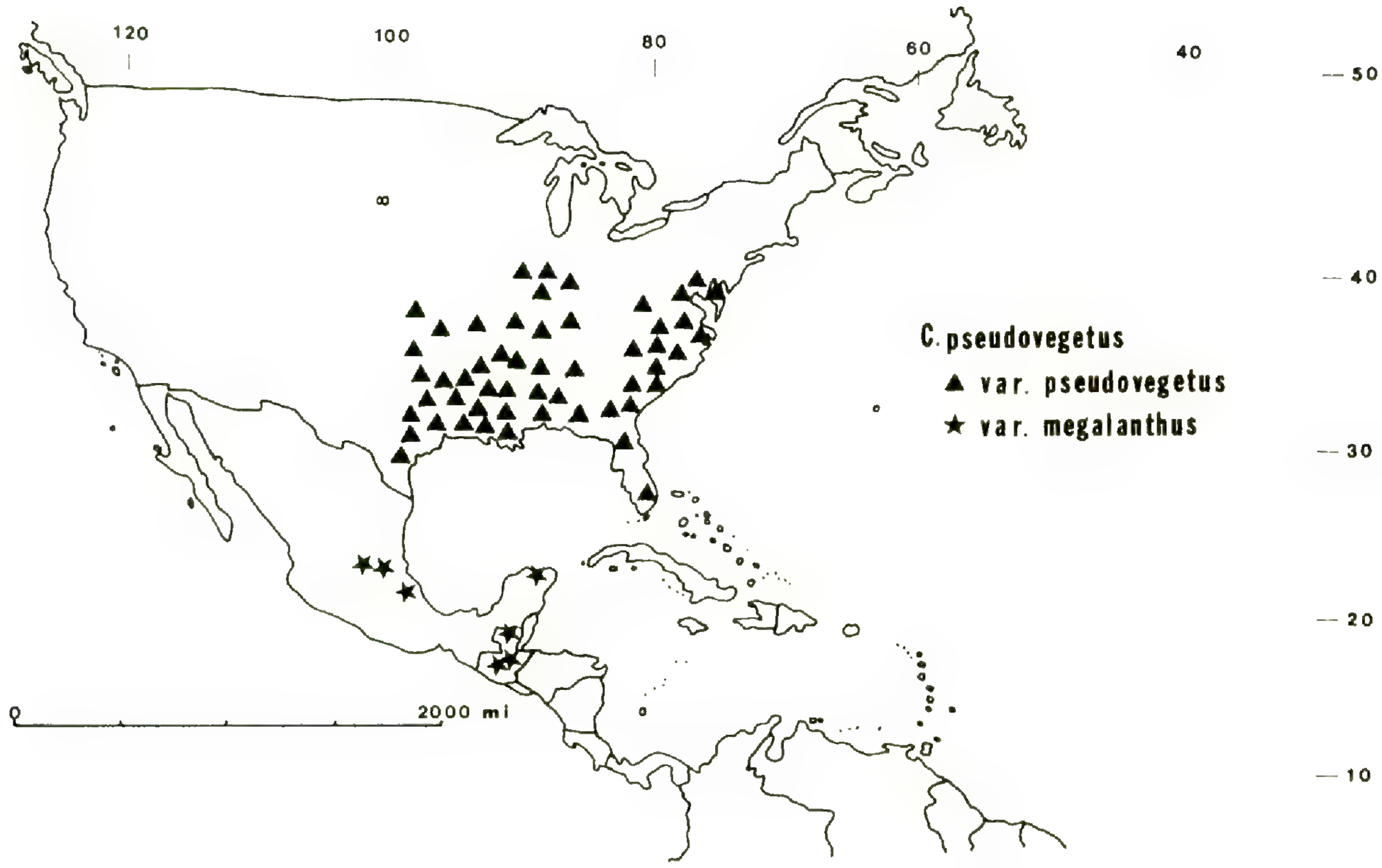

Figure 12. Distribution of *Cyperus pseudovegetus* var. *pseudovegetus* and *C. pseudovegetus* var. *megalanthus*.

DELAWARE: KENT CO: Harrington, Aug 1874, *Canby s.n.* (F, WTU). NEW CASTLE CO: Townsend, 4 Sep 1899, *Canby s.n.* (GH), July 1893, *Canby s.n.* (WTU); 2½ mi SW of Townsend, 18 July 1939, *Tatnall 4289* (GH). SUSSEX CO: Ellendale, 15 July 1878, *Canby s.n.* (F), Aug 1878, *Canby s.n.* (MO); Georgetown, 18 Aug 1937, *Smith 401* (C, CAS).

MARYLAND: DORCHESTER CO: Cambridge, 22 Aug 1873, *Morong s.n.* (F). MONTGOMERY CO: Great Falls, "flats" of Potomac River, 3 Oct 1938, *Hermann 9883* (MICH, NY). ST. MARY'S CO: Scotland, 2 Sep 1923, *Blake 8551* (LL). TALBOT CO: ¾ mi SSW of Unionville, 1 Sep 1947, *Earle 4371* (GH). WICOMICO CO: Quantico, 8 mi SW of Salisbury, 30 Aug 1937, *Smith 404* (UC).

WASHINGTON, D.C.: Potomac Flats, 30 Aug 1899, *Pieters s.n.* (MICH); wet places, 16 July 1896, *Steele s.n.* (GH).

VIRGINIA: ACCOMACK CO: 3½ mi N of Accomac, 16 Oct 1935, *Fernald et al. 5225* (GH). GREENSVILLE CO: swamps of Reedy River, 22 July 1881, *Smith s.n.* (GH). HALIFAX CO: Lawson Creek, J.E.B. Stuart Highway, SW of South Boston, 21 June 1938, *Fosberg 15408* (GH). HENRICO CO: West Hampton, 17 June 1922, *Randolph & Merriman 272* (GH). ISLE OF WIGHT CO: near Fort Eustis, 30 Aug 1941, *Bright 18385* (UC). JAMES CITY CO: about 2 mi W of Five Forks, 1 Aug 1939, *Menzel 246* (GH). MATHEWS CO: Mob Jack Bay, 7 Aug 1875, *Leggett s.n.* (UC). NANSEMOND CO: Suffolk, 13 July 1895, *Blankinship s.n.* (GH). NORFOLK CO: vicinity of Norfolk, 3 July 1892, *Britton et al. s.n.* (F). PRINCESS ANNE CO: near Virginia Beach, 12 July 1893, *Heller 1065* (DS, GH). ROANOKE CO: at base of Fort Lewis Mt. about 1.8 mi from Salem P. O., 21 Aug 1942, *Wood 5094* (GH). SUFFOLK CO: no locality, 24 July 1872, *Curtiss s.n.* (GH). SUSSEX CO: Waverly, 20 July 1891, *Seymour s.n.* (GH). YORK CO: Portsmouth, no date, *Noyes s.n.* (GH); 2 mi S of Yorktown, 13 Sep 1935, *Fernald et al. 4807* (GH, NY).

NORTH CAROLINA: BEAUFORT CO: near Belhaven, 25 June 1935, *Correll 1684* (DUKE). CARTERET CO: 1 mi E of Beaufort, 7 July 1938, *Blomquist 10340* (DUKE). COLUMBUS CO: near Bolton, 17 July 1926, *Heller 14127* (DS, MO, NY); 3 mi E of Hallsboro, 8 July 1927, *Wiegand & Manning 504* (GH); 4 mi E of Bolton, 5 July 1927, *Wiegand & Manning 503* (GH). CUMBERLAND CO: 1½ mi NE of Godwin, 14 Oct 1951, *Fox & Boyce 5640* (DUKE, GH, MICH); ½ mi SE of Rockfish Creek, along N.C. rt. 87 S of Fayetteville, 26 June 1949, *Godfrey & Fox 49361* (DUKE, TEX). CURRITUCK CO: Knotts Island, 4 July 1935, *Correll 2194* (DUKE). DAVIDSON CO: 2.6 mi S of Southmont, 28 Sep 1968, *Leonard 2095* (B); Yadkin River near High Rock, 16 June 1956, *Radford 12949* (LL). DUPLIN CO: 1.5 mi SE of Faison on US 117, 15 June 1957, *Ahles & Haesloop 28455* (UC). DURHAM CO: Duke Forest, 1 Sep 1932, *Blomquist 750* (DUKE); W. Durham, 24 July 1931, *Blomquist 5533* (DUKE). FRANKLIN CO: 4.4 mi W of

Sutton, 3 Nov 1934, *Oosting 34797* (DUKE). GATES CO: near Gatesville, 18 July 1938, *Godfrey 5252* (GH); near Sunburg, 7/5/35, *Correll 2234* (DUKE). GREENE CO: near Snow Hill, 21 June 1935, *Correll 1354* (DUKE); near Farmville, 8 June 1938, *Godfrey 4317* (DUKE, GH). GUILFORD CO: Greensboro, 5 Oct 1960, *Wagner 603* (DUKE). HALIFAX CO: near Scotland Neck, 7 July 1935, *Correll 2378* (DUKE). HERTFORD CO: Camp Co. Forest, E of Como, 23 July 1949, *Godfrey & Fox 49669* (DUKE, GH). JOHNSTON CO: about 4 mi W of Princeton, 5 Aug 1946, *Wood, Jr. 6525* (GH, WTU). LEE CO: 2 mi S of Lemon Springs, 14 July 1966, *Pence 44966* (GH). NASH CO: near Rocky Mount, 7/8/35, *Correll 2479* (DUKE); 1 mi E of Middlesex, 5 July 1949, *Blomquist 14681* (DUKE); near Nashville, 18 July 1938, *Godfrey 5147* (DUKE, GH); 5 mi N of Rocky Mount, 22 July 1949, *Godfrey & Fox 49636* (DUKE); 1 mi E of Rocky Mount, 15 June 1955, *Blomquist & Ebert 16707* (DUKE); NEW HANOVER CO: Wilmington, 1884, *McCarthy s.n.* (TEX). NORTHAMPTON CO: N of Roanoke River bridge, US Rte 258, 9 June 1949, *Godfrey & Fox 49219* (DUKE, UC). ONSLOW CO: 9 mi E of Jacksonville, 2 July 1949, *Blomquist 14633* (DUKE). ORANGE CO: no locality, 12 Aug 1932, *Blomquist 5534* (DUKE). PERQUIMANS CO: 4½ mi S of Hertford, 5 Aug 1950, *Fox 4175* (DUKE); 4 mi N of Winfall, 18 June 1927, *Wiegand & Manning 500* (GH). PITT CO: 2 mi E of Grimesland, 24 June 1927, *Wiegand & Manning 502* (GH); 1 mi E of Bethel, 11 June 1952, *Cappel & Godfrey 107* (UC). ROWAN CO: vicinity of Salisbury, 3 July 1890, *Heller 184* (UC). STANLEY CO: banks of Little Long Creek, Albemarle, 17 Aug 1892, *Small 391613* (F). UNION CO: 3 mi SSE of Waxhaw, 14 July 1957, *Ahles & Haesloop 31402* (GH). WAKE CO: 3.4 mi S of junction US 1 and NC 55 in Apex on NC 55, 27 Aug 1961, *Ahles & Williamson 54944* (DS). WASHINGTON CO: 4 mi E of Plymouth, 20 June 1927, *Wiegand & Manning 501* (GH). WILSON CO: 1 mi SE of Stantonburg, 8 July 1922, *Randolph & Randolph 704* (GH).

SOUTH CAROLINA: AIKEN CO: Aiken, Aug 1870, *Ravenel s.n.* (MICH). BARNWELL CO: no locality, 4 June 1952, *Batson & Kelley s.n.* (UC). BERKELEY CO: Santee River, 3 mi NE of Pineville, 14 July 1939, *Godfrey & Tryon 658* (CAS, GH, MO, UC). CHARLESTON CO: Adams Run, 15 Aug 1939, *Godfrey & Tryon 1545* (GH, NY). DORCHESTER CO: no locality, 16 June 1936, *Correll 5357* (GH). GEORGETOWN CO: 12 mi NW of Georgetown, 21 July 1939, *Godfrey & Tryon 754* (BM, CAS, DS, GH, MICH, UC). JASPER CO. 6.1 mi SW of Ridgeland on US Hwy 17, 26 June 1956, *Bell 3710* (TEX). LEXINGTON CO: Batesburg, 15 June 1913, *McGregor 182* (DS). MARLBORO CO: 9 mi SW of Bennettsville, 10 Aug 1956, *Radford 15466* (C). SUMTER CO: no locality, no date, *Ravenel s.n.* (GH). WILLIAMSBURG CO: 2 mi NE of Lane, 10 July 1939, *Godfrey & Tryon 408* (CAS, MO, NY, UC); 1 mi SW of Lane, 10 July 1939, *Godfrey & Tryon 414* (GH).

GEORGIA: BAKER CO: 3 mi NE of Field Station, 21 Aug 1947, *Thorne 6194* (F, MO). BROOKS CO: just N of Quitman, 20 Sep 1940, *Duncan 2982* (MO). DECATUR CO: near Fourmile Creek, 4 mi S of Bainbridge, 12 July 1947, *Thorne 4618* (GH). DE KALB CO: near Stone Mountain, 20 May 1933, *Miller et al. 452* (MO). DOUGHERTY CO: near Albany, 22 June 1901, *Curtiss 6816* (GH, MO, UC). FLOYD CO: Rome, July 1888, *McCarthy 218* (DS). MCDUFFIE CO: vicinity of Thomson, 16 Aug 1907, *Bartlett 1011* (MICH). MCINTOSH CO: W side of Sapelo Island, W of S tip of Blackbeard Island, 20 Sep 1956, *Duncan 20578* (TEX). MILLER CO: ca 1 mi N of Donaldsonville, 26 Oct 1963, *Godfrey 63200* (TEX). RICHMOND CO: about Augusta, 27 June–1 July 1895, *Small s.n.* (F); 4.5 mi S of Augusta, 5 July 1940, *Radford 580* (TEX, UC). WHITFIELD CO: Mill Creek bottoms, 23 July 1900, *Harper 301* (GH, K, MO).

FLORIDA: BROWARD CO: W of Deerfield, 28 July 1949, *Jackson s.n.* (LL). CALHOUN CO: no locality, no date, *Chapman s.n.* (MO). GADSDEN CO: wooded bank of Chattahoochee, 13 July 1897, *Curtiss 6028* (GH). JACKSON CO: marshy border of Lake Seminole, about 3 mi N of Sneads, 12 Aug 1964, *Henderson 64-427* (MO). LEON CO: no locality, 10 June 1955, *Godfrey 53497* (GH, NY). MADISON CO: no locality, June–July 1898, *Hitchcock s.n.* (MO). MARION CO: no locality, June–July 1898, *Hitchcock 2106*(F).

INDIANA: JEFFERSON CO: near Chelsea, SW of Hanover, 19 Aug 1935, *Banta 56676* (GH). KNOX CO: about 4/5 mi NE of Oaktown, 8 Oct 1938, *Kriebel 7078* (DUKE). POSEY CO: about 3 mi W of Hovey or Bill Nye, about 7 mi SW of Mt. Vernon, 19 Aug 1922, *Deam 37685* (GH, NY).

KENTUCKY: CALLOWAY CO: between Murray and New Concord, 20 July 1937, *Smith & Hodgdon 4080* (GH). CLINTON CO: slough NW of Albany, 18 July 1937, *Smith & Hodgdon 4027* (GH).

TENNESSEE: CARROLL CO: no locality, 27 Aug 1922, *Svenson 431* (GH). COFFEE CO: Tullahoma, 15 July 1938, *Svenson 9408* (GH); Dry Oak Barrens, Tullahoma, 24 Aug 1930, *Svenson 4259* (GH). DAVIDSON CO: Nashville, no date, *Gattinger s.n.* (UC). FRANKLIN CO: marsh at Decherd, Aug 1898, *Ruth 120* (MO). MADISON CO: 7 mi NW of Jackson, 15 July 1939, *Hubricht B1626* (UC). MCNAIRY CO: no locality, 1 July 1893, *Bain 483* (GH).

ALABAMA: CULLMAN CO: Cullman, 16 Aug 1886, *Mohr s.n.* (DS). DE KALB CO: P. O.

Fort Payne, 22 June 1964, *Demaree 50473* (NO). ETOWAH CO: nr. Attalla, 30 June 1895, *Eggert s.n.* (MO). HALE CO: 5 mi S of Sawyerville, 30 June 1966, *Maginness 301* (GH). JEFFERSON CO: Birmingham, Aug 1888, *McCarthy s.n.* (UC). LEE CO: Auburn, 7/3/97, *Earle & Baker s.n.* (MO). LIMESTONE CO: Wheeler Reservoir, 8/4/46, *Isely 4890* (B). MOBILE CO: no locality, Apr, *Mohr s.n.* (MICH).

ILLINOIS: JEFFERSON CO: ponds near Opdyke, 13 Aug 1898, *Eggert s.n.* (MO). MASSAC CO: Metropolis, 15 Aug 1902, *Gleason 2242* (GH). ST. CLAIR CO: Queens Lake, 1 Aug 1891, *Eggert s.n.* (BM, MO).

MISSISSIPPI: FORREST CO: 10 mi SE of Hattiesburg, 5 July 1958, *Kral & Kral 7124* (GH). HANCOCK CO: no locality, 17 Nov 1938, *Penfound s.n.* (NO). LAFAYETTE CO: 4 mi SW of Taylor, 11 Aug 1958, *McDaniel 1004* (MO). MONROE CO: Amory, 21 Sep 1891, *Seymour s.n.* (DUKE).

MISSOURI: BARTON CO: 8 mi N of Iantha, 19 July 1955, *Palmer 60808* (F); 3½ mi SE of Verdella, 19 July 1955, *Palmer 60782* (F). BATES CO: about 4 mi N of Butler, 21 July 1965, *Henderson 65-582* (MO); 3 mi NW of Quinn, 30 Sep 1955, *Palmer 61459* (F). BUTLER CO: Neeleyville, 2 Oct 1892, *Dewart s.n.* (MO). CAPE GIRARDEAU CO: 3 mi W of Arbor, 22 Sep 1946, *Steyermark 64145* (BM). DADE CO: 3 mi SW of Everton, 23 June 1941, *Steyermark 40225* (GH). DUNKLIN CO: Campbell, 9 Sep 1910, *Bush 6281* (GH). HOWELL CO: 7½ mi SW of West Plains, 24 July 1949, *Steyermark 68591* (F). JASPER CO: 2 mi SE of Webb City, 10 Aug 1949, *Palmer 29723* (F); near Webb City, 20 Aug 1927, *Palmer 32604* (GH). MCDONALD CO: no locality, 24 July 1892, *Bush s.n.* (BM, MO). MISSISSIPPI CO: 4 mi W of Charleston, 11 July 1933, *Palmer & Steyermark 41475* (BM). NEW MADRID CO: 2 mi S of Lilbourn, 4 July 1952, *Steyermark 73647* (F). NEWTON CO: about 2 mi S of Neosho, 7 July 1967, *Henderson 67-1141* (CAS); Joplin Chert Barrens, 13 July 1927, *Kellogg 1479* (MO, UC). PHELPS CO: 10 mi SE of Rolla, 2 mi SW of Elk Prairie, 18 Aug 1951, *Steyermark 72479* (F), 22 Sep 1950, *Steyermark 70897* (F). RIPLEY CO: 4½ mi S of Naylor, 28 May 1951, *Steyermark 71265* (F). VERNON CO: 3 mi NW of Milo, 16 July 1950, *Steyermark 69969* (F). WEBSTER CO: 2 mi NW of Niangua, 3 Sep 1951, *Steyermark 72629* (BM, F).

ARKANSAS: BRADLEY CO: Warren, 13 June 1944, *Demaree 25035* (GH). CALHOUN CO: Thornton, 7-4-42, *Demaree 23365* (NO,UC). CHICOT CO: Lake Village, 28 June 1942, *Demaree 23254* (GH, TEX). CLARK CO: Arkadelphia, 25 June 1938, *Demaree 17825* (DS). CLAY CO: near St. Francis River, 3 July 1948, *Demaree 26977* (TEX). CLEVELAND CO: P. O. Kingsland, 28 June 1942, *Demaree 23323* (L). CRAIGHEAD CO: no locality, 6 June 1948, *Demaree 26651* (TEX); Black Oak, 14 June 1927, *Demaree 3360* (BM, CAS); NE Ark., Lake City, 27 June 1927, *Demaree 3437* (MICH). CRITTENDEN CO: Hulbert, 7 June 1937, *Demaree 15182* (UC). DREW CO: P. O. Wilmar, 3 July 1943, *Demaree 24520* (GH). GREENE CO: Walcott, 30 June 1949, *Demaree 27936* (GH, NO). HEMPSTEAD CO: Fulton, 5 Oct 1923, *Greenman 4431* (BM), 17 June 1915, *Palmer 8026* (CAS). HOWARD CO: Mineral Springs, 10 July 1960, *Demaree 42735* (GH). LAWRENCE CO: P. O. Strawberry, 12 July 1947, *Demaree 26206* (GH). MILLER CO: P. O. Texarkana, 30 June 1943, *Demaree 24506* (GH). MONROE CO: Brinkley, 4 Aug 1955, *Demaree 37791* (GH). POINSETT CO: Waldenburg, 13 June 1950, *Demaree 29071* (GH, NO). PRAIRIE CO: P. O. De Valls Bluff, 15 June 1941, *Demaree 22193* (B). PULASKI CO: Little Rock, 9 Aug 1939, *Demaree 19787* (BM, UC); Little Rock, 22 May 1938, *Demaree 17513* (UC). ST. FRANCIS CO: margin of Shell Lake, 8 June 1937, *Demaree 15105* (B, UC). UNION CO: P. O. Strong, 25 June 1939, *Demaree 19400* (B).

LOUISIANA: CALCASIEU PARISH: vicinity of Lake Charles, 25 Aug–10 Sep 1898, *Mackenzie 432* (MO); vicinity of Lake Charles, 28 May 1904, *Allison 256* (GH). CAMERON PARISH: Lacassine Refuge, 27 Apr 1963, *Eggler s.n.* (NO). LINCOLN PARISH: Ruston, Woodland Park, 21 Sep 1970, *McNabb 95* (F). ORLEANS PARISH: New Orleans, no date, *Bomhard 308* (NO). OUACHITA PARISH: near Brownsville, S of Monroe, 14 June 1957, *Ewan 19182* (NO). PLAQUEMINES PARISH: Pointe à la Hache, near Woodinville, 17 Sep 1892, *Langlois s.n.* (MICH). RAPIDES PARISH: vicinity of Alexandria, 8 June 1899, *Ball 594* (F, GH, MO). RICHLAND PARISH: Archibald, 4 July 1958, *Kral & Kral 7093* (GH). SABINE PARISH: no locality, 27 June 1963, *Demaree 48125* (UC). ST. MARTIN PARISH: 1 mi SW of Breaux Bridge, 10 July 1938, *Correll & Correll 9449A* (GH). ST. TAMMANY PARISH: Fontainebleau State Park, Mandeville, 11 June 1966, *Thieret 23402* (TEX). TANGIPAHOA PARISH: S edge of Hammond, 2 July 1938, *Correll & Correll 9325* (GH). WASHINGTON PARISH: along Bogue Chitto River, 1.5 mi S of Enon, 12 June 1966, *Thieret 23466* (TEX).

KANSAS: CRAWFORD CO: 6 mi SE of Pittsburg, 21 June 1929, *Rydberg & Imler 177* (NY).

OKLAHOMA: ATOKA CO: Atoka Lake at Stringtown, 16 July 1970, *Correll & Correll 39172* (LL). COMANCHE CO: no locality, 25 June 1913, *Stevens 1332½* (DS). LE FLORE CO: 2 mi S of Talihina on hwy. 271, 18 Aug 1967, *Mitchell 3833* (LL). LOVE CO: 5 mi SE of Ardmore in Lake Murray State Park, 17 July 1967, *Crutchfield 3447* (LL). MAYES CO: about ¼ mi N of

junction of hwy. 28, 21 Aug 1965, *Correll & Correll 31443* (LL). MCCURTAIN CO: Smithville, 17 Sep 1970, *Correll & Correll 39752* (LL); 10 mi E of Haworth, 23 June 1948, *Waterfall 8041* (DS). MUSKOGEE CO: Haskell Lake, 3 mi NW of Haskell, 13 Aug 1967, *Mitchell 3730* (LL). OSAGE CO: 4 mi N of Hula near the Kansas border, 8 Aug 1967, *Mitchell 3581-A* (LL). OTTAWA CO: near Hatterville, 30 Aug 1913, *Stevens 2471* (DS, GH). PITTSBURGH CO: Arrowhead State Park, 23 Sep 1970, *Correll & Correll 39943* (LL). PUSHMATAHA CO: 3 mi N of Rattan, 24 Sep 1970, *Correll & Correll 39977* (LL). SEQUOYAH CO: 8 mi N of Sallisaw on hwy. 59, 16 Aug 1967, *Mitchell 3797* (LL).

TEXAS: ANDERSON CO: Long Lake, Trinity Valley, 9 June 1899, *Eggert s.n.* (MO); Palestine, 7 June 1920, *Tharp 42* (UC). AUSTIN CO: Austin, 1892, *Wurzlow s.n.* (DS). BASTROP CO: no locality, 15 July 1924, *Duval 29* (TEX). BOWIE CO: about 6.5 mi N of Texarkana, 13 Aug 1966, *Correll 33389* (LL). BRAZOS CO: in marsh, 15 Nov 1941, *Weaver 318* (MICH). CALHOUN CO: Port O'Connor, 19 May 1930, *Tharp s.n.* (TEX). CASS CO: Atlanta, 17 June 1926, *McClung 9199* (TEX). CHAMBERS CO: Anahuac, 22 July 1929, *Tharp s.n.* (TEX). DALLAS CO: Trinity River Bottoms, 20 June 1945, *Lundell 13908* (LL). GALVESTON CO: no locality, 27 June 1942, *Nelson s.n.* (TEX). GREGG CO: 7 mi S of Longview, 16 July 1967, *Mitchell 3198* (LL). HARRISON CO: Marshall, 17 May 1974, *Fleetwood 10961* (LL). HARRIS CO: Houston, 20 July 1919, *Fisher s.n.* (L), 10 June 1937, *Fisher 372*(C, CAS, DS, MICH, NY), *37232* (DS, DUKE). HARRIS CO: N of Houston, 28 mi from Conroe, 19 July 1944, *Lundell 13095* (LL, TEX). HENDERSON CO: Cade Lake, 10 May 1940, *Siegel 164* (TEX). HOUSTON CO: 3 mi N of Crockett, 10 June 1970, *Correll & Correll 38946* (LL). HUNT CO: 4 mi S of Commerce, 16 July 1968, *Correll & Correll 35896* (LL). JACKSON CO: La Ward, 24 July 1951, *Tharp et al. 51-1640* (TEX). JEFFERSON CO: Beaumont, 22 June 1917, *Johnston s.n.* (UC). KAUFMAN CO: SE side of Terrell City Lake, 2¼ mi E of Terrell, 7 Sep 1945, *Cory 49700* (LL). LAMAR CO: about 5 mi NE of Paris, 22 July 1969, *Correll 37519* (LL). LAVACA CO: about 18 mi SE of Yoakum, 16 July 1949, *Tharp et al. 49159* (TEX). MARION CO: edge of small pond adjacent to Caddo Lake at Big Lake Camp, E & N of Leigh, 17 July 1967, *Mitchell 3233* (LL). MATAGORDA CO: Tres Palacios, 20 June 1923, *Tharp 2112* (TEX). MCLENNAN CO: Gaphead, no date, *Smith 862* (TEX). MORRIS CO: 1 mi W of Naples, 20 July 1969, *Correll 37473* (LL). NACOGDOCHES CO: Attoyac River just N of the Rayburn Reservoir on hwy. 103, 26 Aug 1967, *Mitchell 3990* (LL). PANOLA CO: 6.5 mi S of Carthage, 29 July 1956, *Shinners 24267* (NO). TYLER CO: N of Colmesneil and 2 mi S of Neches River, 10 Aug 1968, *Correll & Correll 36031* (LL). WALKER CO: near Huntsville, July 1913, *Young s.n.* (TEX). WALLER CO: Hempstead, 20 Apr 1872, *Hall 680* (F). WOOD CO: E of Mineola, 26 June 1945, *Lundell 13952* (LL); Mineola, 14 Aug 1900, *Reverchon 2296* (MO).

Cyperus pseudovegetus Steudel var. **megalanthus** Kükenthal, Pflanzenreich IV. 20 (Heft 101): 176. 1936. Type: Mexico, San Luis Potosí, banks of streams, Las Canoas, 17 June 1891, *Pringle 3716* (B!, lectotype; CAS!, ENCB!, F!, GH!, M!, MICH!, MSC!, NY!, TEX!, UC!, US!, isolectotypes). Figure 11(E–H).

Plant 30–55 cm tall; leaves 4–7, 17–70 cm long; leaf sheath 3–14 cm long; leaf blade 4.5–8 mm wide at mid-length, usually flat; involucral bracts (5–) 8–18 (–40), 6–42 cm long, 2–6 (–9) mm wide; compound inflorescence 2–5 cm long, often viviparous; primary peduncles absent or 3–7, 1–3.5 cm long and 0.8–1.2 mm wide; secondary peduncles absent or 1–3, up to 1 cm long, ca 0.4 mm wide; primary heads (6–) 10–18 mm wide and with 60–100 spikelets; secondary heads ca 7 mm wide and with ca 40 spikelets; spikelets 3.5–5 mm long, 3–4 mm wide, with 8–18 scales; scale angles 40°–45° (–60°); scales 2–2.5 mm long, 0.7–1 mm wide, apically acute and excurved, the proximal abaxial groove between the two keels 1.2–1.5 mm long; sides of scale stramineous or light brown; stamen 2–2.8 mm long, the filament ca 2 mm long, the anther 0.7–1.0 mm long; style ca 1.3 mm long, the stigmatic branches ca 1 mm long; achene filling one-half to three-fifths of the scale, radially or bilaterally symmetric, four (to six) times longer than wide, 1.2–1.3 mm long (total length), the body ca 1 mm long; achenial surfaces equal or unequal in width, sometimes the adaxial surface 0.1 mm wider than the two abaxial ones.

Distribution. Mexico, from San Luis Potosí southeast to Veracruz and Yucatán, and Guatemala, from Alta Verapaz to Petén. In moist, loamy soil along streams or rivers at elevations of 75 to 350 meters (Fig. 12).

Discussion. Of immediate distinction, the number of involucral bracts ranges from five to forty, surpassing that of any of the related taxa. Correlated with the unusually large number of bracts is the typical condition of several leafy vegetative shoots in the inflorescences. The achenes are generally radially symmetric, but may be bilaterally symmetric when the adaxial surface is slightly wider (by ca 0.1 mm) than the two abaxial surfaces. The achenes are straight, rather than curved toward the adaxial surface as in var. *pseudovegetus.*

Variety *megalanthus* tends to combine morphological features of var. *pseudovegetus* and *C. luzulae.* The scales and achenes are most similar to those of var. *pseudovegetus,* but some of the foliage characters resemble those of *C. luzulae.* Could var. *megalanthus* have arisen via hybridization between these two taxa? The abnormal condition of leafy vegetative shoots in the inflorescences, and the intermediate morphological profile tend to support a hybrid origin for the taxon, but further evidence, particularly cytological and crossing data, are needed to justify more positive conclusions.

Representative specimens:

MEXICO: SAN LUIS POTOSI: along the gravel road to Jalpan ca 12 mi NE of Xilitla, 29 Mar 1961, *King 4382* (F, MICH, TEX, UC). VERACRUZ: Sanborn, 28 Feb 1910, *Orcutt 3243* (BM, MICH, US). QUINTANA ROO: El Paso, 28 Apr 1932, *Lundell 1606* (DS, MICH, US).

GUATEMALA: ALTA VERAPAZ: no locality, May 1904, *Türckheim II 975* (UC, US). PETEN: Petén, 12 Apr 1933, *Lundell 2658* (CAS, MICH, US); Cerro Ceibal (Sierra Mojada, Cerro San Martín), 30 Apr 1942, *Steyermark 46130* (MICH, UC). VERAPAZ: near the Finca Sepacuite, 4 Apr 1902, *Cook & Griggs 437* (UC); Cubilgüitz, M May 1904, *Türckheim 8777* (US).

Cyperus reflexus Vahl, Enum. Pl. 2: 299. 1806.

Rhizomatous (less commonly tufted) perennial up to 80 cm tall; stems erect, round or roundly triquetrous, smooth, grayish green, green, or stramineous, 0.5–1.2 mm wide distally, 1–2.5 mm wide at the base; leaves 3–8, about one-half as long as the stem, up to 40 cm long; leaf sheath mostly red, or light to dark reddish-brown, with inconspicuous transverse septa between the veins, seldom nodulose, often persistent and becoming brown and fibrous; leaf blade 2–2.5 mm wide at mid-length, often conduplicate, occasionally flat, grayish green, light green, or stramineous, attenuate at apex; involucral bracts with the lowermost and longest one usually wiry, stiff, ± erect, elongate, and appearing like a prolongation of the stem (sometimes reflexed by a large sessile head), sheathless or with a sheath less than 1.5 mm long, often conduplicate, sometimes flat, grayish green, light green, or stramineous, with rare and inconspicuous transverse septa between the veins, rarely nodulose, apically attenuate; compound inflorescence 1.5–8 cm long; primary peduncles round, smooth, mostly erect and stiff; secondary peduncles straight; heads globose or hemispherical; bracteoles ovate, 2–3 mm long, 5–10-veined, membranous or crustaceous, apically acute; rachilla 0.15–0.25 mm wide, 0.05 (–0.1) mm thick, straight or slightly arched, stramineous with reddish-glandular, longitudinal striations; scale angles ca 45°; scales (0.8–) 1.5–1.8 (–2.2) mm long, 0.8–1.5 mm wide, or ca 0.5 mm wide and usually triangular in lateral view, adaxially light red, weakly bicarinate basally, apically acute or mucronate and straight (or subtly excurved), the proximal abaxial groove between the two keels 0.4 mm long; medial part of scale firmly membranous, stramineous or yellowish green, seldom scabrellate distally; sides of scale crustaceous, reticulate with conspicuous cells when immature, becoming smooth and glossy when mature, the margins often hyaline and revolute on the upper two-thirds to three-fourths of the scale, basally attached to the rachilla for 0.2–0.3 mm; stamen solitary, 2–2.5 mm long, the filament 1.5–2 mm long, the anther 0.8–1.1 mm long; pollen 25–30 μ in diameter; style 0.8–1 mm long, the stigmatic branches 0.4–0.6 mm long; achene radially

symmetric, trigonous, 0.9–1.4 mm long (total length), the stipitate base less than 0.1 mm long, rarely broadened, and the slender apical beak ca 0.1 mm long; achenial surfaces of equal width, 0.3–0.4 mm wide.

Discussion. Although most taxa in the Luzulae group appear tufted or may have abbreviated rhizomatous structures, the ability to produce elongated, scaly rhizomes is evident only in *C. reflexus*. The distinctive features of this species besides its rhizomatous habit include reddish leaf sheaths, slender stems, and lustrous scales. The lowermost involucral bract appears to be a continuation of the stem, being somewhat stiff, erect, and slender. The involucral bracts are markedly unequal in length and usually number between two and four.

The degree of taxonomic variation is greater in variety *reflexus* than in variety *fraternus*. The two taxa tend to merge with each other to such a degree that I think the recognition of varieties, rather than species, more accurately depicts their interrelationships. Specimens have been collected, particularly in South America, that tend to be morphologically transitional between the two varieties with respect to achene features; these collections are here referred to variety *reflexus*. Both varieties are found in the southern United States, Mexico, and South America; no records are available for either taxon in the Central American countries. Particularly indistinguishable vegetatively, the two varieties are modally distinct in the color of their scales and in the shape of their achenes.

Cyperus reflexus Vahl var. **reflexus**. Type: USA, Texas, no locality specified, *Drummond 1* (NY!, isotype). Figure 13 (E–H).

Cyperus sellowii Link, Hort. Bot. Berol. 1: 307. 1827. Type: Uruguay, Montevideo, *Sello s.n.* (B!, holotype).

Cyperus rufescens Torrey & Hooker, Ann. Lyceum Nat. Hist. New York 3: 436. 1836. Type: USA, Texas, Rio Brazos, *Drummond s.n.* (NY!, lectotype; B!, K!, PH! in part, isolectotypes).

Cyperus haemostachys Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.]: 41. 1854. Type: Chile, in insula Valenzuela et pr. u. Valdivia, Nov. m. 1850, *Lechler 283* (B!, presumably an isotype).

Cyperus baazas Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.]: 316. 1855. Type: Texas, Rio Brazos, *Drummond s.n.* (B!, presumably an isotype).

Cyperus reflexus Vahl var. *macrostachys* Böckeler, Linnaea 35: 559. 1868. Type: Brasil, *Sello s.n.* (B!, holotype).

Cyperus reflexus Vahl var. *genuina* forma *capitata* Osten, Anales Mus. Nac. Montevideo, II. 3: 136. 1931, Type: Uruguay, not cited in description; not found, but description fits var. *reflexus*; var. *genuina* as published refers to var. *reflexus*.

Leaf sheath 2–7 (–12) cm long; involucral bracts 3–4 (–5), up to 15 cm long and up to 2.5 mm wide; compound inflorescence (excluding leafy bracts) 1.5–5 cm long; primary peduncles absent or 3–6 (–8), up to 4 cm long, 0.5–1 mm wide; secondary peduncles usually absent or 1–2, up to 1 cm long and ca 0.5 mm wide; primary heads 10–15 mm wide, with (25–) 50–100 spikelets; secondary heads 8–12 mm wide, with (25–) 40–60 spikelets; bracteoles 2–2.5 mm long, 5-veined; spikelets (2.5–) 4–10 (–22) mm long, 0.8–1.5 (–2.8) mm wide, with (6–) 12–24 scales; rachilla with transverse scale scars 0.5–0.6 mm apart on each side; sides of scale dark red or sometimes stramineous distally; achene filling two-fifths to three-fifths of the scale, brown or black, broadly trigonous, acutely angled, two and one-half times longer than wide, 0.9–1.1 mm long (total length), the body 0.8–1 mm long; achenial surfaces 0.4 mm wide, usually obovate (less frequently elliptic), slightly concave or sometimes planar.

Distribution. In the United States known only from Texas; in Mexico from Guanajuato, Jalisco, and México; disjunct to South America, where it occurs in Bolivia, Brazil, Argentina, Chile, and Uruguay. Found in moist sandy depressions, sandy clay grasslands, low floodable ground, open woodlands, rock crevices along streams or rivers, from sea level to 2200 meters in elevation (Fig. 14).

Figure 13. A–D. *Cyperus surinamensis* (based on *Rzedowski & McVaugh 728*); A, habit, × ½; B, spikelet, × 5; C, scale, × 15; D, achene, × 15. E–H. *Cyperus reflexus* var. *reflexus* (based on *McVaugh 12780*); E, inflorescence, × ½; F, spikelet, ×5; G, scale, × 15; H, achene, × 15. I–K. *Cyperus reflexus* var. *fraternus* (based on *Pringle 11724*); I, spikelet, × 5; J, scale, × 15; K, achene, × 15. L–O. *Cyperus luzulae* (based on *Díaz Luna 426*); L, inflorescence, × ½; M, spikelet, × 5; N, scale, × 15; O, achene, × 15.

Discussion. Characters of the achenes and scales are the most reliable for distinguishing this taxon. The achenes are broadly trigonous and two to two and one-half times longer than wide and have obovate (infrequently elliptic) and concave surfaces. The scales typically have deep red or reddish brown sides and a stramineous to yellowish green medial portion. This pattern may vary in South American specimens where the scales may be completely red or where the medial portion may be yellowish

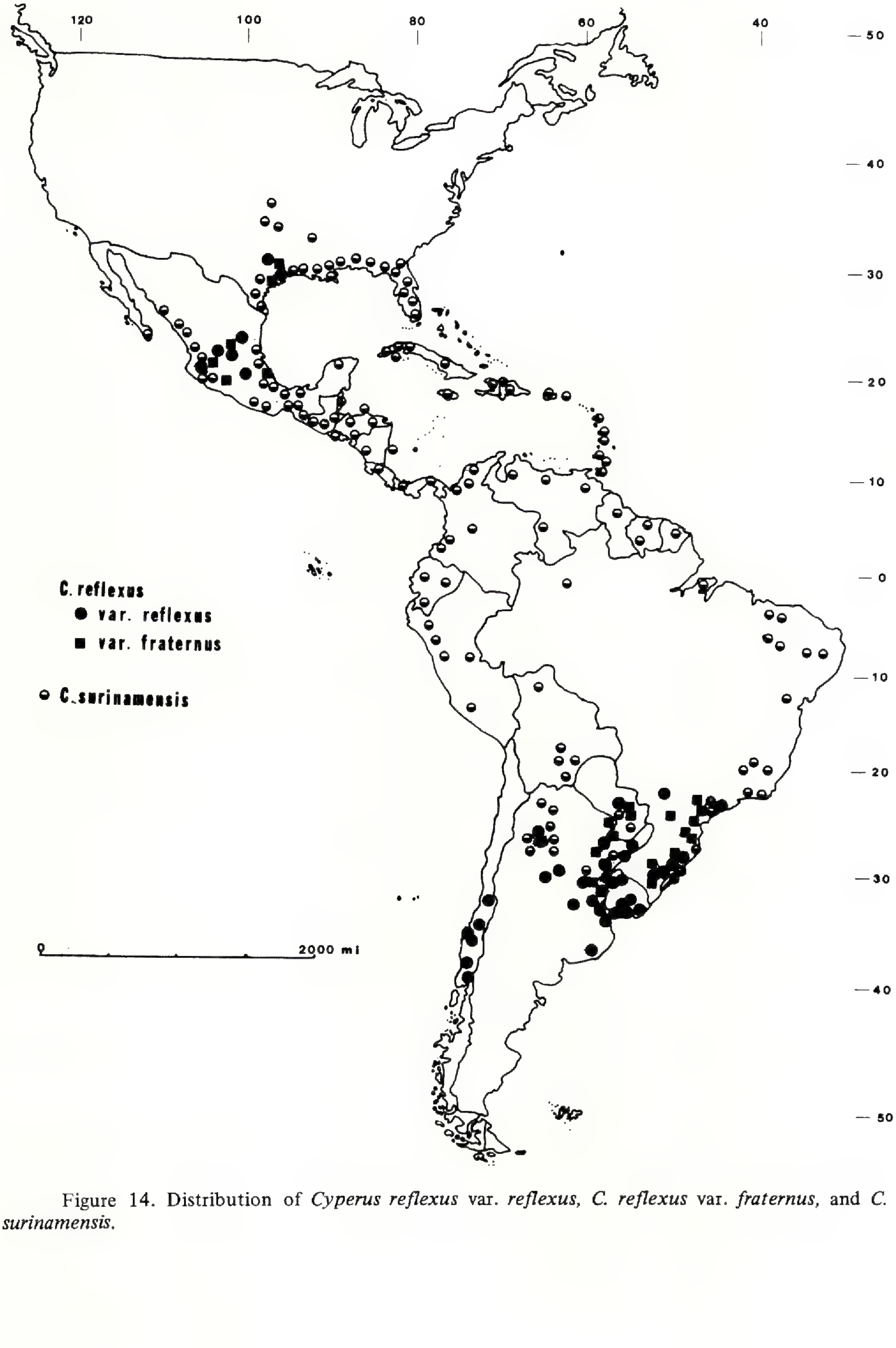

Figure 14. Distribution of *Cyperus reflexus* var. *reflexus*, *C. reflexus* var. *fraternus*, and *C. surinamensis*.

green or stramineous either proximally or distally while the rest is red. In some populations from Argentina, the scales formed on plants subjected to frequent flooding are about two-thirds the average size for this variety. The smaller scales are distinctive but do not justify the recognition of a new taxon.

Variation of the compound inflorescence may be notable but without taxonomic significance, as in the development of the primary and secondary peduncles. In certain South American specimens, a single large head of spikelets may terminate the stem when the peduncles fail to develop. Normally, primary peduncles are evident and may number as many as eight. Secondary peduncles and their corresponding heads have been observed only in a few North American collections. A distortion of the heads occurs when the spikelets are infected with a smut, *Testicularia cyperi* (noted on *Hall 679*).

Taxonomic relationships of this variable and widely distributed taxon are difficult to assess. In Texas, *C. acuminatus* and *C. pseudovegetus* have reddish spikelets and leaf bases and tend to resemble var. *reflexus.* There may be hybridization among all these taxa, but the hybrids have not been clearly identified. Hybridization involving var. *reflexus* is indicated by the presence of aborted achenes on several collections. These sterile plants exhibit features characteristic of var. *reflexus*: prominently red scales, short scaly rhizomes, and obovate achenial surfaces.

Representative specimens:

UNITED STATES OF AMERICA: TEXAS: BRAZORIA CO: Brazoria Wildlife Refuge, Salt Cedars, 10 July 1968, *Fleetwood 9278G* (LL). BRAZOS CO: W of College Station, 8 June 1965, *Massey 961* (LL). HARRIS CO: Houston, 25 Apr 1961, *Traverse 2041* (A, TEX). DEWITT CO: near Hochheim, May 1961, *Johnston 6222a* (TEX). NUECES CO: Corpus Christi, May 1913, *Orcutt 5816* (BM).

MEXICO: GUANAJUATO: no locality, 1902, *Dugès 17* (GH). JALISCO: along highway 2 mi S of Ojuelos de Jalisco, 6 Sep 1956, *McVaugh 12780* (MICH, US). ESTADO DE MEXICO: San Felipe, Mpio. de Cuautitlán, 4 Apr 1966, *Mitastein 107* (ENCB).

SOUTH AMERICA: BOLIVIA: DEPT. UNKNOWN: no locality, no date, *Bang 2920* (GH, MO).

BRAZIL: MINAS GERAIS: Caldas, 28 Oct 1868, *Regnell 1458* (C). RIO GRANDE DO SUL: Pôrto Alegre, Jan 1929, *Jürgens 164* (B), Jan 1929, *Jürgens 169* (B); Ponta Grossa, Pôrto Alegre, 8.1.1934, *Orth 690* (C, GH, MO, UC); São Leopoldo, Pôrto Alegre, 6.10.1937, *Orth 718* (C, GH, UC); Pôrto Alegre, Feb 1898, *Reineck s.n.* (LY), Nov 1898, *Reineck & Czermack 443* (M).

PARAGUAY: CENTRAL: near Villeta, 16 Nov 1969, *Pedersen 9323* (C).

URUGUAY: ARTIGAS: Catalán, Nov 1927, *Herter 341a* (M). CANELONES: Bañados de Carrasco, no date, *Caldevilla s.n.* (MICH); Parque Plata, 7 Dec 1947, *Herter 341l* (B). FLORIDA: La Palma, 11 16 Apr 1938, *Herter 341h* (B). MONTEVIDEO: Malvin, Dec 1925, *Herter 341* (B, GH, M, MO, UC); Montevideo, 2 Jan 1931, *Osten 22164* (GH). ROCHA: Palmares de Castillos, 25 km N of Castillos, 22 Jan 1944, *Bartlett 21391* (MICH, TEX, UC). SAN JOSE: Barra Sta. Lucía, 30 Dec 1930, *Osten 22166* (GH).

ARGENTINA: BUENOS AIRES: 30 km SE of La Plata, on Magdalena road, 9 Dec 1938, *Eyerdam et al. 23387* (GH, MO, UC); 10 km N of Mar del Plata, 11 Dec 1938, *Eyerdam & Beetle 23630* (UC); between Cascallares and Copetonas, 22 Apr 1949, *Pedersen 351* (C). CORDOBA: Sierra Achala, Jan 1877, *Hieronymus 788* (B). CORRIENTES: Mburucuyá, Santa María, 3 Dec 1951, *Pedersen 1360* (C); Mburucuyá, Santa Teresa, 18 Jan 1953, *Pedersen 1930* (C), 3 Nov 1965, *Pedersen 7481* (C); Empedrado, Las Tres Marías, 15 Dec 1954, *Pedersen 3042* (C), 18 Oct 1964, *Pedersen 7098* (C); Empedrado, La Yela, 1 June 1972, *Pedersen 10175* (C); Curuzú Cuatiá, Aguay, 13 Nov 1964, *Pedersen 7128* (C); Saladas, Pago Los Deseos, 6 Mar 1969, *Pedersen 9054* (C); Santo Tomé, Paso Concepción, 23 Apr 1969, *Pedersen 9106* (C); Concepción, Buena Vista, 12 Dec 1972, *Pedersen 10267* (C). ENTRE RIOS: Concordia, 15 Dec 1957, *Pedersen 4728* (C); Federación, Buena Esperanza, 23 Oct 1961, *Pedersen 6264* (C, L); Uruguay, La Selmira, 20 Nov 1964, *Pedersen 7215* (C), *7263* (C); Las Aguadas, 26 Nov 1964, *Pedersen 7334* (C); Colón, 2 Feb 1967, *Pedersen 8032* (C); Federación, near Villa del Rosano, 26 Mar 1967, *Pedersen 8150* (C).

CHILE: ACONCAGUA: Valle de Marga-Marga, coast ranges southeasterly from Valparaíso, no date, *Jaffuel & Pirion 3302* (GH), *3308* (GH); Depto. Los Andes, Cerro Cache, ca 18 km E of La Ligua, 29 Dec 1938, *Morrison 17043* (MO, UC). BIO-BIO: and der Laguna Laja, 31 Jan 1972, *Zöllner 6244* (L). CONCEPCION: Concepción, 1893–1896, *Neger s.n.* (M). VALDIVIA: "Ouinchilca," Dec 1941, *Hollermayer 1347* (UC); Panguipulli, 6 Mar 1928, *Hollermayer 2348* (GH); near Trumao Mission, 2 km W of Trumao, 21 Dec 1935, *West 4840* (GH, UC).

Cyperus reflexus Vahl var. **fraternus** (Kunth) Kuntze, Rev. Gen. 3, pt. 2: 334. 1898. Basionym: *Cyperus fraternus* Kunth, Enum. Pl. 2: 42. 1837. Type: Brazil, no locality specified, *Sello s.n.* (B!, holotype). Figure 13 (I–K).

Cyperus surinamensis Rottbøll var. *strictus* Kükenthal, Pflanzenreich IV. 20 (Heft 101): 175. 1936. Type: Paraguay, in regione cursus superioris fluminis Apa, Dec 1901, *Hassler 8195* (B!, holotype; BM!, GH!, LY!, MICH!, NY!, UC!, isotypes).

Leaf sheath 2–13 cm long; involucral bracts 2 (–4), up to 18 cm long and 1.5–3 mm wide; compound inflorescence (excluding leafy bracts) up to 4 (–8) cm long; primary peduncles absent or 2–4, up to 4 cm long and ca. 0.5 mm wide; secondary peduncles absent; primary heads 12–20 mm wide, with 25–60 spikelets (up to 80 in sessile heads); bracteoles 2.5–3 mm long, 7–10-veined; spikelets 6–11 mm long, 1.5–2.3 mm wide, with (18–) 24–34 (–42) scales; rachilla with transverse scale scars 0.3 mm apart on each side; sides of scale usually stramineous but occasionally brown, reddish brown, or pale red; achene filling three-fifths to three-fourths of the scale, brown or reddish brown, narrowly trigonous, obtusely angled, ca three times longer than wide, 0.9–1.4 mm long (total length), the body 0.8–1.2 mm long; achenial surfaces 0.3 mm wide, narrowly ovate or narrowly elliptic, planar.

Distribution. In the United States known only from Texas; in Mexico, from San Luis Potosí, Michoacán, Jalisco, and Veracruz; in South America, from Brazil, Argentina, and Paraguay. Occurring on low floodable ground by rivers or around lakes, or in clayey grasslands at elevations from 150 to 2300 meters (Fig. 14).

Discussion. Features of the achenes provide the best distinction between the two varieties of *C. reflexus.* In var. *fraternus,* the narrowly trigonous achenes are about three times longer than wide and have surfaces that are planar. Characteristically, secondary peduncles are completely lacking, and the scales are typically stramineous or light brown when mature, seldom reddish.

It can be speculated that var. *fraternus* is a hybrid derivative of var. *reflexus* and *C. surinamensis.* The achenes of var. *fraternus* resemble those of *C. surinamensis,* but var. *fraternus* has smoother stems, shorter spikelets, fewer scales per spikelet, and glossier and longer scales than those of *C. surinamensis.* Also, var. *fraternus* exhibits distinctive scaly rhizomes which are lacking in *C. surinamensis.*

Representative specimens:

UNITED STATES OF AMERICA: TEXAS: MATAGORDA CO: College Port Prairie, 22 Aug 1929, *Tharp 9150* (TEX). WALLER CO: Hempstead, 1 June 1873, *Hall 679 in part* (F, K, NY).

MEXICO: SAN LUIS POTOSI: Sierra de San Miguelito, cerca de Cueva de Mezquite, 9 Nov 1954, *Rzedowski 5470* (ENCB); in paludosis Morales, 1876, *Schaffner 564* (GH). JALISCO: wet soil near Guadalajara, 10 Oct 1903, *Pringle 11724* (CAS, F, GH, MICH, MO, US). MICHOACAN: Morelia, 1/9/1910, *Arsène 6654* (US). VERACRUZ: Casitas-Gutiérrez Zamora cerca Ejido Villa Cuauhtémoc, 21 June 1970, *Nevling & Gomez-Pompa 1179* (WTU).

BRAZIL: PARANA: Pinhaes, 7.1.1909, *Dusén 7779* (BM); Tibagi, Rio Tibagi, 10 Oct 1965, *Hatschbach 12898* (F, UC). RIO GRANDE DO SUL: Farroupilha, 18 Nov 1957, *Camargo 2568* (B); Taquari, 14 Dec 1957, *Camargo 2971* (B); Pôrto Alegre, p. Sta. Maria, 1.1.1956, *Camargo 58893* (B); Mun. Rio Pardo, Oct 1922, *Jürgens 18* (B). SAO PAULO: Butantan, 10 Jan 1921, *Gehrt 5418* (GH), *Hoehne 5418* (B, GH). SANTA CATARINA: Fazenda Frei Rogério, Pôrto União, 6.1.1962, *Reitz & Klein 11.625* (L), 26 Oct 1962, *Reitz & Klein 13.614* (L); Morro do Pinheiro Sêco, Lajis, 17 Dec 1962, *Reitz & Klein 14.010* (UC).

PARAGUAY: MISIONES: Santiago, La Soledad, 17 Oct 1967, *Pedersen 8633* (C), 18 Oct 1967, *Pedersen 8647* (C). SAN PEDRO: Distr. Lima, Est. "Carumbé," 28 Nov 1969, *Pedersen 9425* (L, UC).

ARGENTINA: CORRIENTES: Depto. Empedrado, "La Yela," 21 Apr 1956, *Pedersen 3887* (UC); Depto. Mburucuyá, 26 Nov 1959, *Pedersen 5299* (A, L); Itati, Tuyuti, 29 Sep 1972, *Pedersen 10196* (C).

Cyperus surinamensis Rottbøll, Descr. Ic. Rar. 35. *Pl. 6, fig. 5.* 1773. Type: Not located, but description and figure in protologue adequate for typification. Figure 13 (A–D).

Cyperus denticulatus Schrader ex J. A. Schultes in Roemer & Schultes, Syst. Veg. Mantiss. 2: 104. 1824. Type: Brasil, *Prinz von Wied-Neuwied* ["In Brasilia, Princ. Ser. Max. Neowid."] (LE?, holotype, not seen).

Cyperus subenervius Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.]: 27. 1854. Type: Uruguay, Montevideo, *Deloche s.n.* (not seen, but description applicable).

Cyperus bipontini Böckeler, Flora 40: 33. 1857. Type: Mexico, Veracruz, *Sartorius s.n.* (B!, holotype).

Cyperus surinamensis Rottbøll var. *viridis* Böckeler, Linnaea 35: 555. 1868. Type: Brasil, Prov. Sta. Catharina, Itajahy, 12 Nov 1886, *Schenck 1116* (B!, neotype, annotated by Böckeler).

Cyperus surinamensis Rottbøll var. *lutescens* Böckeler, Linnaea 35: 555. 1868. Type: Lagoa Santa, Nov, *Warming s.n.* (C!, neotype, annotated by Böckeler).

Tufted perennial, seldom an annual, up to 60 (–80) cm tall; stems erect, stiff to flexuous, triquetrous to round, retrorsely scabrellate on the upper one-half or for its full length, seldom smooth, grayish green, green, or stramineous, 0.4–2.5 mm wide distally, 1–5 mm wide at the base; leaves 3–9, mostly one-half to three-fourths as long as to equalling the stem, up to 65 cm long; leaf sheath 2–8 cm long, brown or green, seldom reddish, with few inconspicuous transverse septa between the veins, weakly nodulose if at all, occasionally persistent and becoming dark brown and fibrous the second year; leaf blade (1.5–) 3–10 mm wide at mid-length, usually flat, grayish green, green, or stramineous, acute to attenuate at apex; involucral bracts 3–8, foliaceous and spreading, 2–15 (–31) cm long, 1–4 mm wide, sheathless or with a sheath less than 1 mm long, usually flat, grayish green, green, or stramineous, rarely with inconspicuous transverse septa between the veins, seldom nodulose, apically attenuate; compound inflorescence 1–8 (–14) cm long; primary peduncles absent or 4–14, 1–6 (–9) cm long, 0.8–1 mm wide, round or slightly flattened, usually scabrellate, slightly flexuous; secondary peduncles absent or (1–) 5–7, 1 (–3) cm long, ca 0.5 mm wide, straight; heads hemispherical, the primary ones 12–24 mm wide and with 10–55 spikelets, the secondary ones 10–15 mm wide and with 6–20 (–30) spikelets; bracteoles ovate, 1.8–2.5 mm long, 5–9-veined, membranous or coriaceous, apically acute; prophyll of spikelet 0.1–1 mm long, hyaline and membranous, without veins; spikelets oblong or nearly linear, (3–) 4–14 (–16) mm long, 1.5–2 (–2.5) mm wide, apically acute, with (10–) 20–58 (–72) scales; rachilla 0.15–0.2 mm wide, 0.1 mm thick, straight or arched, adaxially yellowish brown and mostly with reddish glandular, longitudinal striations, the transverse scale scars 0.3–0.5 mm apart on each side; scale angles ca 45°; scales 1–1.5 mm long, 0.8–1 mm wide, or 0.3–0.6 mm wide and triangular in lateral view, adaxially with few red glands, distinctly bicarinate basally, apically acute or obtuse and straight or subtly excurved, the proximal abaxial groove between the two keels 0.3–0.4 (–0.6) mm long; medial part of scale firmly membranous, elevated on the veins and concave between, green or stramineous, often scabrellate distally; sides of scale membranous and reticulate with conspicuous cells, usually pale yellow, sometimes light brown, seldom reddish brown, the margins hyaline and revolute on the distal two-thirds of the scale, basally attached to the rachilla for 0.15–0.2 mm; stamen solitary, 1–1.5 mm long, the filament 0.9–1.3 mm long, the anther ca 0.5 mm long; pollen ca 25 μ in diameter; style ca 1 mm long, the stigmatic branches ca 0.5 mm long; achene filling one-half to three-fifths of the scale, radially symmetric, light to dark brown or reddish brown, narrowly (and weakly) trigonous, obtusely angled, about three times longer than wide, 0.7–0.9 mm long (total length), the stipitate base less than 0.1 mm long, the body 0.6 (–0.8) mm long, and the slender apical beak up to 0.1 mm long; achenial surfaces equal in width, 0.2–0.3 mm wide, elliptic, planar.

Distribution. In the United States *C. surinamensis* occurs from Florida west to Texas, and in Oklahoma and Kansas; it is widely distributed in the Greater and Lesser Antilles, Mexico, Central America, and South America. It grows on peaty or sandy soils around ponds, or in grassy meadows, marshes, depressions in pine forests, cypress

or mangrove swamps, sandy prairies, dry woodlands with *Bursera* and cacti or leguminous shrubs and cacti, or on muddy banks of streams in tropical forest, from sea level to 1830 meters in elevation (Fig. 14).

Discussion. *Cyperus surinamensis* is one of the most distinct taxa in the Luzulae group and is characterized by slender, scabrellate stems, small scales with reticulate surfaces, and narrowly trigonous achenes. Its wide distribution could have been achieved or aided by easy dispersal of the small achenes and the readily deciduous scales. Specimens collected in Jamaica and Puerto Rico, some from Mexico, and one from Louisiana (*Thieret 31645*) exhibit smooth stems that are slightly larger than average. Variability of the number and length of primary peduncles and of the size of the heads is evident, but of no taxonomic significance. Although most populations are perennial, a few appear to be annual.

Representative specimens:

UNITED STATES OF AMERICA: GEORGIA: DECATUR CO: NE of Bainbridge, 14 Nov 1974, *Godfrey 74103* (LL).

FLORIDA: ALACHUA CO: sandy strand of Burnette Lake, E of Alachua, 30 July 1927, *Wiegand & Manning 506* (GH). CHARLOTTE CO: 15 mi NNW of Ft. Meyers, 29 July 1958, *Kral 7529* (GH). CITRUS CO: Homasassa Springs, 7 June 1958, *Kral & Kral 6694* (GH). COLLIER CO: N of Golden Gate subdivision, 20 July 1965, *Lakela 20927* (BM). DADE CO: glades S of Long Pine Key, 24 Apr 1952, *Robertson 212* (GH). DUVAL CO: near Jacksonville, 13 July 1894, *Curtiss 5003* (F, GH). GADSDEN CO: no locality or date, *Chapman s.n.* (GH, K). GILCHRIST CO: 3 mi E of Trenton, 25 July 1961, *Godfrey & Reinert 61080a* (DUKE). GULF CO: ¼ mi NW of Port St. Joe, 6 July 1958, *Kral & Kral 7177* (GH). HENDRY CO: About 4 mi W of Labelle, 15 Aug 1963, *Henderson 63-1605* (TEX). HILLSBOROUGH CO: vicinity of Gibsonton, 18 Sep 1975, *Godfrey 74448* (LL); W of Brandon on hwy. 60, 31 Oct 1960, *Lakela 23492* (DUKE); Tampa, 24 Aug 1895, *Nash 2475* (GH, MICH). JACKSON CO: ca 2 mi W of Lake Seminole, road to Dellwood, 7 Nov 1965, *Godfrey 64920* (TEX). LAKE CO: Eustis, June–July 1894, *Hitchcock 2107* (F); 2.2 mi N of Lady Lake, 19 Sep 1965, *Ward & Carmichael 5124* (DUKE). LEON CO: Lake Bradford, 13 July 1955, *Godfrey 53638* (DUKE). ORANGE CO: 10 mi E of Orlando, 12 Aug 1957, *Kral 5448* (GH). OSCEOLA CO: 1 mi W of Holopaw, 8 June 1960, *Ward & Myint 1959* (DUKE). PALM BEACH CO: N side of Old Okeechobee Road, West Palm Beach, 30 Nov 1968, *Cassen 454* (C). POLK CO: along S shore of Lake May, Winter Haven, 31 Dec 1965, *Mazzeo 1132* (UC, WTU). PUTNAM CO: near Palatka, 21 May 1935, *Scott s.n.* (DUKE). SEMINOLE CO: Seminole, W side of Prairie Lake, 10 Nov 1961, *Schallert 28655* (BM). TAYLOR CO: 1.2 mi SE of Salem, 7 Oct 1964, *Godfrey 64715* (LL). WAKULLA CO: about 2 mi W of Panacea, 1 Aug 1964, *Henderson 64-375* (CAS).

ALABAMA: MOBILE CO: eastern outskirts of Mobile along US 31, 5 Sep 1965, *Kral 23915* (ENCB).

MISSISSIPPI: JACKSON CO: along hwy. 63 at Escatawpa River, 18 July 1954, *Diener 1458* (NO). HARRISON CO: sandy bottoms of Escatawpa River, P. O. Moss Point, 14 Aug 1952, *Demaree 32781A* (GH).

ARKANSAS: COUNTY NOT KNOWN: central Arkansas, July 1892, *Harvey 4* (GH).

LOUISIANA: BEAUREGARD PARISH: Merryville, 26 Oct 1969, *Thieret 31918* (DUKE). CALCASIEU PARISH: ca 2.5 mi SE of Moss Bluff, 14 July 1969, *Thieret 31645* (LL). ORLEANS PARISH: Audubon Park, 9 May 1935, *Penfound s.n.* (NO). PLAQUEMINES PARISH: Pointe à la Hache, 5 Aug 1881, *Langlois s.n.* (DS, F); Mississippi banks, Sep 1880, *Langlois 358* (F).

KANSAS: HARVEY CO: 3 mi E, 2 mi N of Burrton, 11 Oct 1967, *Stevens 19167* (DS, UC).

OKLAHOMA: BRYAN CO: one mi E of Denison Dam of Lake Texoma, 18 June 1950, *Kelting 206* (UC). STEPHENS CO: old Duncan Lake about 8 mi E of Duncan, 22 Sep 1970, *Correll & Correll 29891* (LL).

TEXAS: ARANSAS CO: Aransas Wildlife Refuge, 19 Sep 1968, *Fleetwood 9341* (LL). BASTROP CO: McDade, 14 Aug 1936, *Tharp s.n.* (TEX). CAMERON CO: 25 mi N of Brownsville, 2 July 1941, *Runyon 2761* (CAS). CHAMBERS CO: Trinity River delta, ca ¼ mi S of head of Passes, 15 July 1958, *Traverse 817* (LL, TEX). GRIMES CO: in marsh, 28 Sep 1941, *Weaver 205* (MICH). GUADALUPE CO: 13 mi S of Seguin, 16 July 1958, *Correll & Johnston 19683* (LL). HARRIS CO: San Jacinto River N., sandy soil, Humble, 8 Aug 1946, *Boon 402* (TEX). JIM HOGG CO: 28 mi S of Hebbronville, 25 June 1952, *Correll & Johnston 25534* (LL). KENNEDY CO: Las Norias, 20 July 1943, *Runyon 3186*. KLEBERG CO: Riviera, 9 Sep 1929, *Tharp s.n.* (TEX). SAN PATRICIO CO: Welder Wildlife Refuge, along shore of Pollito Lake, 26 Sep 1960, *Jones 4275*

(TEX). TRAVIS CO: Colorado River at Austin, 7 Nov 1940, *Innes 282* (GH); Lake Austin, 24 Nov 1928, *Tharp 9202* (TEX). WILLACY CO: Raymondville bordering highway 186, 18 Apr 1941, *Runyon 2664* (CAS); Redfish Bay, 3 Mar 1934, *Tharp s.n.* (TEX).

MEXICO: BAJA CALIFORNIA: Baja California Sur, San José del Cabo, 26 Sep 1890, *Brandegee 602* (UC); eastern outskirt of San José del Cabo, 7 Jan 1959, *Wiggins 14711* (DS). SONORA: Alamos, Quiricoba, 12 Nov 1933, *Gentry 765* (DS, MICH). TAMAULIPAS: E of San José, 17 Feb 1939, *LeSueur 22* (TEX); vicinity of Tampico, 1–31 Jan 1910, *Palmer 176* (GH, MO, NY, US). AGUASCALIENTES: 16 km al N de Aguascalientes sobre la carretera a Rincón de Romos, 15 Oct 1973, *Rzedowski & McVaugh 728* (MICH). SINALOA: Mazatlán, Dec 1925, *Ortega 5935* (DS, GH); vicinity of Culiacán, 21 Apr 1910, *Rose et al. 14060* (US); vicinity of Mazatlán, 6 Apr 1910, *Rose et al. 14123* (US). NAYARIT: 3 mi NE of Puga, 22 Aug 1959, *Feddema & King 903* (DS, DUKE, ENCB, MICH, TEX); valley of the Río Jesús María near the village of Jesús María, 20 Sep 1960, *Feddema 1322* (MICH); vicinity of Acaponeta, 9 Apr 1910, *Rose et al. 14235* (NY). JALISCO: 19 km S of Guadalajara, 16 Sep 1961, *Detling 8640* (ENCB, MICH); 9 mi S of Yahualica, 6 Nov 1959, *McVaugh & Koelz 264* (ENCB, MICH); Río Blanco, June–Oct 1886, *Palmer 191* (DS, GH, MICH, US); wet places near Guadalajara, 15 Nov 1888, *Pringle 1786* (F, GH, LL, M, MICH, MO, NY, UC, US); 50 km al N de Guadalajara, 28 Oct 1968, *Puga 2376* (ENCB); Llano Verde, cerca de los Corales, Mpio. de Tecalitlán, 25 Oct 1963, *Rzedowski 17478* (ENCB, MICH). COLIMA: hwy. 80, ca 80 km from Pacific, 30 May 1973, *Burton & Zarkin 6* (MICH); Colima, July 1897, *Palmer 1* (US). MICHOACAN: Puente Jaripo, km 551 carr. México-Guadalajara, 25 Dec 1963, *Galicia & Cruz Fa 1.-453* (ENCB); Cerro de Carboneras above the Río Cupatizio, ca 22 km S of Uruapan, 16–22 Oct 1961, *King & Soderstrom 4874* (MICH, TEX, UC, US). GUERRERO: 20 mi NE of Acapulco, 20 Aug 1947, *Barkley et al. 17M752* (TEX); Mesa Frijolar, 14 Oct 1936, *Hinton 9689* (US); Adama Dist., Sierra Madre del Sur, N of Río Balsas, Santo Tomás, 29 Nov 1937, *Mexia 8924* (B, CAS, GH, MO, NY, UC); Acapulco and vicinity, Oct 1894–Mar 1895, *Palmer 291* (GH, US); Acapulco, 25 June 1952, *Troublefield & Rowell 2816B* (MICH). MORELOS: barranca al W de Cuernavaca, 6 Nov 1967, *Flores Crespo 190* (ENCB); Cuernavaca, 3 Jan 1899, *Deam 4* (GH, MICH, US); Colonia Las Guacamayas, 5 Aug 1966, *Pascoe 288* (ENCB). MEXICO: Dist. Temascaltepec, Ixtapan, 16 July 1932, *Hinton 1067* (DS, NY), 1 Apr 1933, *Hinton 3732* (US), 27 Jan 1936, *Hinton et al. 8884* (US). PUEBLA: Orizaba, 29 July 1891, *Seaton 64* (GH, NY, US); 15 km SE of Izúcar de Matamoros, sobre la carretera a Acatlán, 29 Nov 1972, *Rzedowski 28949* (ENCB). VERACRUZ: Río Maquina, Montepio, Mpio. de San Andrés Tuxtla, 20 Mar 1965, *Cruz Cisneros 153* (ENCB); near the city of Veracruz, 23 Jan 1906, *Greenman 30* (GH); SW edge of Coatzacoalcos, 2 July 1969, *Marcks & Marcks 875* (LL); Coatzacoalcos, 21 Mar 1910, *Orcutt 3257* (MICH, MO, US); Antigua, Sep 1912, *Purpus 6247* (GH, MO, UC, US); 6 km al S de Ciudad Alemán, 20 Mar 1965, *González Quintero 549* (ENCB); Montepio, 19 km al E de Catemaco, 19 Mar 1965, *González Quintero 2203* (ENCB); arroyo en Potrero 2 km NW de Laguna Verde, 26 June 1972, *Vazquez 865* (F). OAXACA: Valley of Oaxaca, 19 Apr 1896, *Conzatti 92* (GH); canteras de Ixcotel, 24 Oct 1932, *Conzatti 4802* (MICH); ½ km E of Tehuantepec, 30 June 1958, *King 308* (MICH); 4 km NW of Zanatepec, 10 July 1958, *King 485* (ENCB, MICH); 2 km N of Ixhuatán, 23 July 1959, *King 1993* (TEX); near San Gabriel, 13 Feb 1965, *McVaugh 22413* (ENCB, MICH); vicinity of Cuicatlán, 8–24 Oct 1894, *Nelson 1665E* (US), *1665*(F); near Tomellin, 2–3 Sep 1905, *Rose et al. 10049* (US). CHIAPAS: Plain below Venustiano Carranza (San Bartolomé), 30 July 1958, *Kaplan 279* (F); Escuintla, 1 Oct 1936, *Matuda 298* (GH, MICH). TABASCO: Playa Azul, 22 km WNW of Paraíso, 5 May 1963, *Barlow 32/2* (GH); Playa Limón-Paraíso, 23 Aug 1962, *Guerrero O. s.n.* (ENCB); near Santa Ana, 1962, *Marcks 62c/12* (MICH); Santa Anita, 5 Feb 1890, *Rovirosa 707* (US). YUCATAN: Progreso, 11–15 Aug 1932, *Swallen 2962* (MICH, US).

BRITISH HONDURAS: BELIZE: 3 mi N of Sibun River, 9 mi S of Belize, 24 Aug 1936, *O'Neill 8981* (GH, UC); New Town, 4 Sep 1932, *Schipp 922* (GH, MICH, MO, NY, UC).

GUATEMALA: AMATITLAN: Morán, Laguna near Izabal, 30 Jan 1906, *Kellerman 6726* (F, US). CHIMALTENANGO: near Finca La Alameda, near Chimaltenango, 7 Dec 1938, *Standley 59150* (F). ESCUINTLA: along Río Guacalate, NW of Escuintla, 14 Mar 1941, *Standley 89328* (F). HUEHUETENANGO: along Río Cuilco, between Cuilco and Aldea of San Juan, 2½ mi W of Cuilco, 18 Aug 1942, *Steyermark 50850* (F). IZABAL: vicinity of Quiriguá, 15–31 May 1922, *Standley 24060* (GH, MO). JUTIAPA: vicinity of Jutiapa, 24 Oct–5 Nov 1940, *Standley 74915* (F). SAN MARCOS: Río Suchiate, just W of Ayutla, 18 Mar 1940, *Steyermark 38032* (F). SANTA ROSA: Cuajiniquilapa, Sep 1893, *Heyde & Lux 6263* (GH, MICH). SOLOLA: 1 km N of Panajachel, 21 June 1970, *Harmon & Dwyer 2635* (ENCB). SUCHITEPEQUEZ: between Tiquisate and Río Bravo, 19 June 1942, *Steyermark 47867* (UC).

EL SALVADOR: LA LIBERTAD: vicinity of Alteos, 17 Apr 1922, *Standley 23396* (GH, US). SAN VICENTE: Laguna de Apastepeque, 23 Oct 1950, *Fassett 28341* (F, GH); vicinity of San Vicente, 2–11 Mar 1922, *Standley 21279* (GH, US). SONSONATE: vicinity of Armenia, 18 Apr 1922, *Standley 23518* (GH, NY, US).

HONDURAS: ATLANTIDA: vicinity of Tela, 14 Dec 1927–15 Mar 1928, *Standley 53735* (US), *54788* (US). COMAYAGUA: El Banco, 3 Apr 1945, *Rodríguez 2636* (F); vicinity of Comayagua, 12–23 Mar 1947, *Standley & Chacón 5997* (F); plain near Siguatepeque, 7 Nov 1936, *Yuncker et al. 5804* (GH, MICH, MO). MORAZAN: vicinity of El Zamorano, 22 July 1949, *Standley 21548* (F); Tegucigalpa, 8 Sep 1946, *Williams & Molina R. 10508* (A, MICH, UC).

NICARAGUA: MANAGUA: Lake Managua, vicinity of Managua, 24 June 1923, *Maxon 7292* (GH, US); Massachuapa, along stream 200 m from beach, 26 Jan 1969, *Stevens & Stergios 171* (MSC). ZELAYA: Corn Island, Waula Point, 9 Mar 1971, *Svenson 4414* (BM).

COSTA RICA: GUANACASTE: 21 km N of Liberia, 21 July 1966, *Davidse & Pohl 803* (MO); Finca la Taboga, 13 km SW of Cañas, 16 Aug 1968, *Davidse & Pohl 1214* (F, MO); 10 km S of Cañas, 10 Mar 1965, *Godfrey 66955* (MO); Comelco, property near Bagaces, 28 June 1971, *Opler 266* (F). LIMON: Río Grande de Terraba, El Paso, Feb 1891, *Tonduz 3578*(US); at the beach of Boca Banana, Feb 1895, *Tonduz 9124* (US). PUNTARENAS: 1 km NW of Boca de Barranca, 15 Aug 1968, *Davidse & Pohl 1208* (MO); roadside near Boca Barranca, 20 Aug 1938, *Worth 8907* (GH, MO, UC).

PANAMA: CANAL ZONE: between Gorgona and Tabernilla, 15 Sep 1911, *Hitchcock 8104* (US); between Frijoles & Monte Lirio, 18 Oct 1922, *Killip 12178* (GH, US); vicinity of Fort Sherman, 15 Jan 1924, *Standley 31170* (US); Darien Station, 19 Jan 1924, *Standley 31540* (US). COLON: Miguel de la Borda, 20 Apr 1970, *Croat 9815* (MO); between Matías Hernández & Juan Díaz, 21 Jan 1924, *Standley 31954* (US).

CUBA: PINAR DEL RIO: vicinity of Herradura, 26–30 Aug 1910, *Britton et al. 6407* (NY, US); Nueva Gerona, 28 Nov 1956, *Killip 45762* (US); Vedado, Habana, 5 Jan 1940, *Bro. Leon 17438* (GH); vicinity of La Gloria, Camagüey, 30 Jan 1909, *Shafer 173* (BISH, US); vicinity of Sumidero, 6–8 Aug 1912, *Shafer & Bro. Leon 13658* (NY, US).

JAMAICA: ST. MARY PARISH: nr. Annotto Bay, 29 May 1960, *Adams 7228* (BM, M).

HAITI: NORD-OUEST: vicinity of St. Louis-du-Nord, 7 Apr 1929, *Leonard & Leonard 14413* (US).

DOMINICAN REPUBLIC: MONTECRISTI: Guayubín, 13–21 Feb 1921, *Abbott 976* (NY, US). TRUJILLO: Valdesia Valley, 19 Nov 1947, *Allard 17031* (NY, US), 19 Nov 1947, *Allard 17050a* (US).

PUERTO RICO: ARECIBO: near railroad track, from Manatí to Vega Baja, 20 July 1901, *Underwood & Griggs 973* (US). BAYAMON: near Bayamón, 2 Nov 1963, *Br. A. Liogier 10339* (F). GUAYAMA: Mpio. de Guayama, 27 July 1965, *Stimson 1739* (DUKE, GH, LL, MICH, MO, UC, US). HUMACAO: Humacao, July 1880, *Eggers s.n.* (LY), June 1881, *Eggers s.n.* (LY); Mt. Britton, Luquillo National Park, 20 Nov 1937, *Jones 11015* (GH); Luquillo Mountains, El Yunque National Forest, 11 Aug 1965, *Stimson 1925* (DUKE). MAYAGUEZ: Mayagüez, 31 Mar 1913, *Britton 2360* (US); along the railroad north of Mayagüez, 12 Feb 1900, *Heller 4578* (F, L).

GUADELOUPE: no locality, 15 Sep 1894, *Duss 3524* (C, US).

MARTINIQUE: Rivière-Salée, 1899, *Duss 690* (NY), *690a* (MO); Morne Rouge, 7 Jan 1949, *Stehlé 6486* (US).

ST. LUCIA: Soufrière, along roadsides, 3 June 1958, *Proctor 18191* (A, BM).

GRENADA: St. Georges, 8 Apr 1905, *Braodway s.n.* (GH, NY); Grenville, 30 Oct–11 Dec 1957, *Proctor 16885* (A, BM, US).

TRINIDAD: coastal plain, Carenage, 25 Feb 1920, *Britton & Hazen 2* (GH); Moruga seashore, 5 June 1908, *Broadway 2388* (M); Port-of-Spain, 9 Oct 1925, *Broadway 5815* (DUKE, MO, UC).

TOBAGO: ad Bucolil, Oct 1889, *Eggers 5385* (C); Caledonia, 14 Jan 1953, *Hunnewell 19903* (GH).

SOUTH AMERICA: COLOMBIA: ANTIOQUIA: ca 1 km W of Turbo, 11 Mar 1962, *Feddema 1831* (MICH). ATLANTICO: Barranquilla and vicinity, Aug 1927, *Bro. Elias 310* (GH, NY); Las Flores near Barranquilla, Jan 1932, *Bro. Paul 943* (F). BOLIVAR: Canabetal, Río Magdalena, 15 Jan 1918, *Pennell 3888* (MO). VALLE DEL CAUCA: Buenaventura, 27 May 1939, *Alston 8674* (BM).

VENEZUELA: AMAZONAS (TERR.): Pto. Ayacucho, 23 May 1940, *Williams 13084* (F). BOLIVAR: along rocky cascades of Río Upata, W of Upata, 31 July 1944, *Steyermark 57550* (F). TRUJILLO: ¼ mi inland from La Ceiba, 13 Mar 1931, *Reed 939* (B).

GUYANA: no locality, Jan 1962, *Reichgelt s.n.* (L).

SURINAM: NICKERIE: 45 km above confluence with Lucie River, vic. Kayser Airstrip, 25 Aug 1963, *Irwin et al. 55229* (F, NY). PARAMARIBO: Paramaribo, 28 Nov 1955, *Jonker 33* (NO, UC); Tafelberg (Table Mt), Charlesburg Rift, 3 km N of Paramaribo, 5 Apr 1944, *Maguire 22735* (MICH).

FRENCH GUIANA: CAYENNE: Cayenne, Mar 1910, *Santini s.n.* (L).

ECUADOR: GUAYAS: Balao, 1898, *Eggers 14106* (L), Feb 1892, *Eggers 14489* (M), Mar 1892, *Eggers 14522* (L, M). LOS RIOS: Est. Exp. Tro. Hda., "Picilingue," 15 June 1951, *White 5639* (NO).

PERU: CAJAMARCA: Prov. Cutervo, Valley of Río Sucse, west of Socota, 9 Dec 1938, *Stork & Horton 10107* (UC). LAMBAYEQUE: km 28 E of Olmos, Muro Highway between Olmos and Jaén, 7 Jan 1964, *Hutchison & Wright 3461* (UC), road to Jaén, km 17 E of Olmos at the Bridge of Silence, 18 Mar 1964, *Hutchison & Wright 4426* (UC). SAN MARTIN: Arroyo Bravo, about 40 km from Tingo María on highway to Pucallpa, 180 km from Huánuco at bridge over Arroyo Bravo, 1 Nov 1949–5 Jan 1950, *Allard 20389* (UC).

BOLIVIA: SANTA CRUZ: Choreti, 3 mi from Camiri, 11 Sep 1949, *Brooke 5609* (BM); Buenavista, 27 Dec 1924, *Steinbach 6821* (B, F). TARIJA: Villa Montes, Pilcomayo, 20 Oct 1927, *Troll 434* (M).

BRAZIL: BAHIA: ca 10 km S of Cocos, 15 Mar 1972, *Anderson et al. 37011* (NY). CEARA: margin of Lagoa Mecejana, Mecejana, 28 July 1935, *Drouet 2146* (MICH); Fortaleza, 12 Aug 1935, *Drouet 2221* (F, MO). GOIAS: Serra Geral do Paranã, 30 km by road S of Saõ João de Aliança, 23 Mar 1973, *Anderson 7791* (NY). MARANHAO: Mun. de Lorêto, about 35 km S of Lorêto, 23 Mar 1962, *Eiten & Eiten 3750* (L). MINAS GERAIS: N. Minas, Várzea de Palma, 23 Nov 1962, *Duarte 7426* (M). PARA: Ilha de Marajó, 19–20 June 1934, *Swallen 4948* (B). PERNAMBUCO: Tapera, 18 June 1933, *Pickel 2611* (B, CAS). RIO DE JANEIRO: Río de Janeiro, Sep, *Martius 5126* (M). RIO GRANDE DO SUL: Ponta Grossa, Pôrto Alegre, Jan 1929, *Jürgens 168* (B); P. Alegre, 14 Jan 1933, *Orth 702* (CAS, MO). SANTA CATARINA: Itajaí, 26 Nov 1961, *Klein 2.844* (L, UC), 13 May 1962, *Klein 2.897* (L, UC). SAO PAULO: São Paulo, 2/4/1926, *Hoehne & Gehrt 17714* (B); Santo, Guarjua, 25 July 1907, *Usteri 9372* (B).

PARAGUAY: SAN PEDRO: Distr. Lima, "Carumbe," 29 Nov 1969, *Pedersen 9433* (C, L).

ARGENTINA: CORRIENTES: Depto. Concepción, Tabay, 1-11-1965, *Krapovickas & Cristóbal 11618* (UC); Depto. Lavalle, "La Pastoril," 25 Nov 1971, *Pedersen 10035* (C); Depto. Mburucuyá, Santa Teresa, 6/12/1951, *Pedersen 1373* (C, MO, NY). SANTA FE: Bajada Grande, 20 Nov 1925, *Barros 200* (F). SANTIAGO DEL ESTERO: Río Hondo, 25 Feb 1941, *Ousset 39* (GH). TUCUMAN: Tucumán, 18 Nov 1913, *Monetti 1316* (GH).

Cyperus virens Michaux, Fl. Bor.-Amer. 1: 28. 1803.

Perennial, tufted or sometimes shortly rhizomatous; stems generally rigidly erect, triquetrous, roughly scabrous or scabrellate (rarely smooth) on the acute and often winged angles, green or stramineous, 2–5 mm wide distally, 3–7 (–12) mm wide at the base; leaves 4–12, one-half as long as to slightly exceeding the stem, (20–) 40–86 cm long; leaf sheath brown, with prominent transverse septa between the red veins, evidently nodulose, often persistent and becoming dark brown to black and fibrous the second year; leaf blade usually flat, grayish green, light green or stramineous, with conspicuous transverse septa between the veins, nodulose, attenuate at apex; involucral bracts (4–) 6–9 (–11), foliaceous and spreading, sheathless or with a sheath 2 mm long or less, usually flat, grayish green, light green or stramineous, with conspicuous transverse septa between the veins, nodulose, the apices attenuate; compound inflorescence 3–17 cm long; primary peduncles 2–15, up to 14 cm long, 1–2 mm wide, triquetrous, scabrellate and winged on the angles, rigid; secondary peduncles absent or 1–5, up to 3 cm long, 0.5–1 mm wide, triquetrous, scabrellate and minutely winged on the angles, straight; heads hemispherical, the primary ones 10–30 (–35) mm wide, the secondary ones 8–15 mm wide; bracteoles ovate, 5–9-veined, firmly membranous to crustaceous, apically acute, acuminate or cuspidate; prophyll of spikelet ca 1 mm long, firmly membranous, 7–9-veined; spikelets narrowly ovate or oblong, apically acute; rachilla 0.25–0.3 mm wide, ca 0.1 mm thick, mostly straight (only slightly arched), dark reddish brown; scales triangular in lateral view, adaxially with reddish glands in longitudinal striations, distinctly to weakly bicarinate basally, apically acute to mucronate and straight; medial part of scale chartaceous or subcartilaginous, sometimes scabrellate distally; sides of scale firmly membranous to crustaceous, roughened and reticulate with large cells when young but becoming smooth and glossy at maturity, the margins revolute on the upper three-fourths of the scales; stamens one or two, 1.5–2.5 mm long, the filaments 1.2–2 mm long, the anthers 0.8–1 mm long; pollen 20–30 μ in diameter; achene radially to bilaterally symmetric, rarely slightly asymmetric, (1–) 1.2–1.5 mm long (total length), the stipitate base less than 0.15 mm long, sometimes broadened, the slender apical beak 0.1–0.15 mm long; achenial surfaces equal or slightly unequal in width.

Discussion. *Cyperus virens* is the most variable of the species in the Luzulae group and has many characters considered to be generalized. It is the best candidate for the ancestral type from which the other taxa might have evolved. It is a widely distributed species with four varieties, all of which are allopatric as far as can be determined. Variety *virens* is widespread throughout North and South America; variety *montanus* is restricted to the southern part of South America; and var. *drummondii* and var. *minarum* have disjunctive distributions that span both continents. The four varieties share the following: foliage leaves and involucral bracts that are conspicuously nodulose and transversely septate, and triquetrous stems that are scabrous and winged. These features are not found in combination in related taxa. The variation evident in some collections with regard to scale dimensions and achene features prevents the elevation of these taxa to specific rank.

Cyperus virens Michaux var. **virens.** Type: USA, Carolina, *Michaux s.n.* (P, holotype; photograph of holotype, GH!). Figure 15 (A–D).

Cyperus formosus Vahl, Enum. Pl. 2: 327. 1806. Type: no locality specified, *Fuspen s.n.* (C!, isotype).

Cyperus baenitzii Böckeler, Flora 61: 140. 1878. Type: Argentina, Concepción del Uruguay, Apr 1877, *Lorentz 139* (B!, holotype).

Cyperus surinamensis Rottbøll var. *formosus* (Vahl) Kükenthal, Repert. Spec. Nov. Regni Veg. 32: 74. 1933.

Plant (40–) 60–120 cm tall; leaf sheath 2–12 (–20) cm long; leaf blade (4.5–) 7–14 mm wide at mid-length; involucral bracts up to 50 cm long, up to 14 mm wide; primary peduncles 6–12 (–14), up to 14 cm long; secondary peduncles, when evident, up to 3 cm long; primary heads with 10–50 spikelets, the secondary ones with 9–15 (–40) spikelets; bracteoles 3–3.5 mm long; spikelets (5–) 7–15 mm long, 2–3.3 mm wide, with (12–) 16–30 (–36) scales; rachilla with transverse scale scars 0.5–0.6 mm apart on each side; scale angles 30°–45° (–rarely 60°); scales 1.5–2.1 (–2.4) mm long, 0.9–1.2 (–1.5) mm wide, or 0.4–0.6 mm wide in lateral view, the proximal abaxial groove between the two keels 0.7–1 mm long; medial part of scale green when young, ripening to stramineous or light brown, seldom reddish brown; sides of scale light brown to golden brown (seldom reddish brown), basally attached to the rachilla for 0.2 mm; stamens one or two, 1.5–2.5 mm long, the filaments 1.2–2 mm long, the anthers 0.8–1 mm long; style 0.8–1 mm long, the stigmatic branches ca 0.6 mm long; achene filling one-half to three-fourths of the scales, radially or bilaterally symmetric, brown or reddish brown, narrowly trigonous, obtusely angled, three to five times longer than wide, (1–) 1.2–1.5 mm long (total length), the body 0.9–1.1 mm long; achenial surfaces equal or unequal in width, 0.3–0.5 mm wide, the adaxial surface sometimes 0.1 mm wider than the two abaxial ones, elliptic or narrowly ovate, planar or slightly concave.

Distribution. Widely distributed from the southeastern United States south through central Mexico to Colombia, Venezuela, Brazil, Paraguay, and Argentina. Habitats include brackish cypress-tupelo swamps, sand pits, rice and wheat fields, wet roadside ditches, swales, irrigation canals, depressions in pine-oak forests or *Celtis* groves, from sea level to 2640 meters in elevation (Fig. 16).

Discussion. The distinguishing features for variety *virens* are generally those for the species, but in habit it is larger than varieties *drummondii* or *minarum.* There are morphological trends evident for this taxon along a north-south gradient. With more northern latitudes, there is an increase in the sizes of achenes, scales, and stems and in the number of foliage leaves.

Variants tend to be few. Smooth stems, rather than scabrous ones, are seldom found. In a Chapman specimen from Florida, some of the stipitate bases of the achenes are 0.15 mm wide, about 0.05 mm wider than in most other populations.

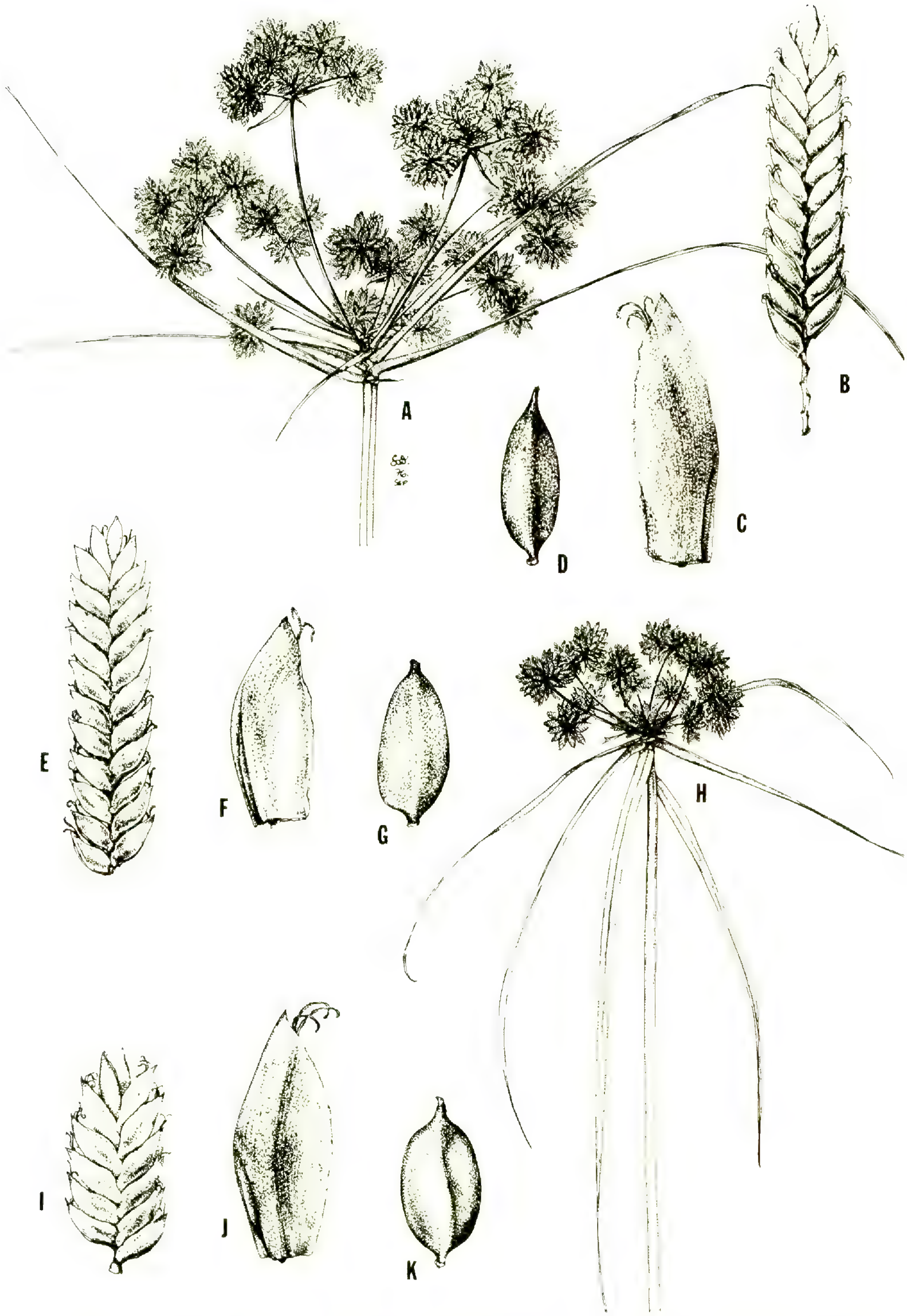

Figure 15. A–D. *Cyperus virens* var. *virens* (based on *Moore 3468*); A, inflorescence, × ½; B, spikelet, × 5; C, scale, × 17.5; D, achene, × 17.5. E–G. *Cyperus virens* var. *drummondii* (based on *Wiggins 18572*); E, spikelet, × 5; F, scale, × 17.5; G, achene, × 17.5. H–K. *Cyperus virens* var. *minarum* (based on *Ton 1265*); H, inflorescence, × ½; I, spikelet, × 5; J, scale, × 17.5; K, achene, × 17.5.

Distorted spikelets infected by a smut, *Testicularia cyperi,* are found on several specimens (Florida, *Henderson 64-425*; Louisiana, *Demaree 48215*; Texas, *Gould 6918*).

Representative specimens:

UNITED STATES OF AMERICA: NORTH CAROLINA: CARTERET CO: Davis, 14 July 1949, *Blomquist 14729* (DUKE). WASHINGTON CO: ½ mi SE of Plymouth, 4 July 1922, *Randolph & Randolph 752* (GH).

Figure 16. Distribution of *Cyperus virens* var. *virens.*

SOUTH CAROLINA: BEAUFORT CO: near Bluffton, 19 June 1936, *Correll 5417* (DUKE, GH). BERKELEY CO: 10 mi NE of Marcks Corners, 24 July 1939, *Godfrey & Tryon 888* (GH). JASPER CO: Savannah National Wildlife Refuge, 3 Nov 1960, *Hotchkiss 7708* (LL); 4.6 mi NW of Tillman on S-119, 17 Sep 1967, *Radford et al. 11490* (BM, C, LL, NO, TEX, UC, WTU).

GEORGIA: BAKER CO: shallow sink dissected by Newton road 3 mi NE of Field Station, 21 Aug 1947, *Thorne 6193* (GH). CHATHAM CO: Cockspur Island, 21 June 1938, *Eyles 4078* (DUKE); Tybee Island, 27 June 1938, *Eyles 4201* (DUKE). DOUGHERTY CO: 6 mi S of Albany, 28 June 1947, *Thorne 5002* (GH, NY). JENKINS CO: edge of Magnolia Springs, 8 Aug 1942, *Duncan 5621* (MO). MCINTOSH CO: San Domingo State Park, Darien, 11 July 1937, *Eyles 2097* (DUKE).

FLORIDA: CALHOUN CO: just E of Blountstown, 6 June 1956, *Redfearn 2197* (DUKE, NY). FRANKLIN CO: Apalachicola, July–Sep, *Chapman 2135a* (C, GH, MO, NY). JACKSON CO: marshy shores of Lake Seminole, N of Sneads, 28 Oct 1958, *Godfrey 57890* (DUKE, GH), 12 Aug 1964, *Henderson 64-425* (CAS). LAKE CO: vicinity of Eustis, 16–31 May 1894, *Nash 841* (GH, K, MICH, NY). LEON CO: 2 mi E of Tallahassee, 16 July 1957, *Godfrey 56608* (GH, NY). MADISON CO: marshes at Greenville, 24 June 1956, *Godfrey & Kral 54922* (DUKE, GH). WAKULLA CO: 4 mi E of St. Marks River at Newport, 23 July 1961, *Ward 2737* (DUKE).

ALABAMA: BALDWIN CO: S of Warden's Camp, Mobile Delta, 25 July 1947, *Lueth L64* (DUKE). MONTGOMERY CO: Montgomery, 1888, *McCarthy s.n.* (GH).

MISSISSIPPI: JACKSON CO: Ocean Springs, 5 Aug 1889, *Earle 1361* (GH), 5 Aug 1889, *Tracy 105* (NY). LINCOLN CO: 4 mi SE of Bogue Chitto, 10 Aug 1955, *Ray 5395* (GH). PEARL RIVER CO: 3 mi W of Picayune, 27 June 1967, *Sargent & Jones 13766* (TEX).

LOUISIANA: ACADIA PARISH: Crowley, 12 Oct 1911, *Chambliss s.n.* (NO). ALLEN PARISH: ca 8 mi N of Elton, 20 June 1968, *Thieret 29557* (LL). CAMERON PARISH: ca 10 mi W of Holly Beach, ca 30 mi SW of Hackberry, 14 Dec 1957, *Reese & Harris 1536* (GH, NO). EAST BATON ROUGE PARISH: 1 mi E of Baton Rouge, 27 June 1938, *Correll & Correll 9119* (DUKE, GH). IBERIA PARISH: in salt marsh along canal on Avery Island, 11–15 July 1938, *Correll 9563* (DUKE). JEFFERSON PARISH: 5 mi S of Marrero on La Fitte Road, 5 June 1948, *Ewan 17710K* (BM, NO). LAFAYETTE PARISH: 1 mi SE of Broussard, 6 July 1938, *Correll & Correll 9371* (DUKE, GH, NY); ca 5 mi S of Lafayette, 5 Oct 1957, *Reese 1414* (GH, NO). ORLEANS PARISH: Audubon Park, 9 July 1928, *McArthur s.n.* (NO). PLAQUEMINES PARISH: wet lands, Sep 1880, *Langlois 363* (F), July 1880, *Langlois s.n.* (GH). RAPIDES PARISH: vicinity of Alexandria, 8 June 1899, *Ball 594* (GH). RED RIVER PARISH: 11 mi W of Coushatta on U.S. Highway 84 (1 mi W of Grand Bayou), 27 July 1956, *Shinners 24171* (NO). SABINE PARISH: Sabine River, Toledo Bend Reservoir, 27 June 1963, *Demaree 48215* (NO). ST. BERNARD PARISH: bank of La Borgne Canal about 1 mi E of Violet, 31 Aug 1959, *Lemaire 1742* (NO). ST. CHARLES PARISH: Willswood, 16 Apr 1961, *Eggler s.n.* (NO). ST. MARTIN PARISH: 1 mi SW of Breaux Bridge, 10 July 1938, *Correll & Correll 9449* (DUKE, GH). ST. TAMMANY PARISH: Covington, 16 May 1964, *Demaree 49988* (NO); Martinville, July 1890, *Langlois s.n.* (DS, MO). ST. MARY PARISH: Cote Blanche Island, 13 May 1961, *Ewan 20325* (BM, NO). TANGIPAHOA PARISH: 4 mi E of Hammond, 26 Sep 1959, *Shireman 39* (NY). TERREBONNE PARISH: Houma, 10 July 1942, *George & Shephard s.n.* (TEX); near Houma, 30 June 1918, *Small s.n.* (WTU). VERMILION PARISH: 3.5 mi E (by road) of Gueydan along road to Kaplan, 27 May 1967, *Thieret 26331* (TEX).

TEXAS: ARANSAS CO: northern part of Aransas National Wildlife Refuge, 13 June 1953, *Johnston 5320.27* (TEX). BASTROP CO: no locality, 14 Aug 1936, *Tharp s.n.* (NY, TEX, UC). BRAZORIA CO: Angleton, 17 July 1972, *Fleetwood 1011A* (MO). BRAZOS CO: 6 mi W of Bryan, 29 Sep 1940, *Curry 22* (CAS). CAMERON CO: 22 mi N of Brownsville, 30 July 1944, *Runyon 3980* (TEX). CHAMBERS CO: Anahuac, 21 July 1929, *Tharp 9207* (TEX); Anahuac Natl. Wildlife Refuge, 16 June 1964, *Vantries 1* (TEX). FORT BEND CO: Richmond, 4 Sep 1930, *Fisher s.n.* (MICH). GONZALES CO: 7 mi S of Gonzales, 6 July 1957, *Correll & Johnston 17491* (LL). GUADALUPE CO: no locality, 15 Aug 1940, *Kellogg s.n.* (TEX, UC). HARDIN CO: 1¾ mi NE of Batson, 12 Nov 1945, *Cory 50762* (LL). HARRIS CO: 8 mi E of Cypress, 6 Oct 1965, *Correll 31923* (LL); Houston, 8 June 1937, *Fisher 374* (DS, DUKE, NY, TEX, UC). JEFFERSON CO: about 1 mi N of Nome, 16 Oct 1967, *Correll 35152* (LL); 5½ mi W of Beaumont, 10-5-1934, *Cory 11028* (GH). LIBERTY CO: Trinity River bottomland about 1 mi E of Dayton, 25 Oct 1967, *Correll 35277* (LL); 7.5 mi S of Clark, 15 June 1955, *Gould 6918* (TEX, UC). NACOGDOCHES CO: Attoyac River just N of the Rayburn Reservoir on hwy. 103, 26 Aug 1967, *Mitchell 3993* (LL). ORANGE CO: Port of Orange, 27 June 1967, *Correll 34280* (LL); Orange, 11 Aug 1880, *Letterman 28* (MO, NY). REFUGIO CO: Austwell, 9.7.1929, *Tharp s.n.* (TEX). SABINE CO: about 1 mi SW of Hemphill, 10 May 1969, *Correll 37222* (LL). SAN PATRICIO CO: Odem, 2 June 1922, *Tharp 2121* (TEX). RUSK CO: 10.6 mi E of Henderson, 10 Aug 1954, *Shinners 14060* (TEX). WALLER CO: Hempstead, 6 June 1872, *Hall 680* (GH, K, NY). WILLACY CO: Raymondville, 8 Aug 1941, *Fisher 41189* (F, TEX). WILSON CO: Sutherland Springs, 23 July 1944, *Cory 45181* (TEX).

CALIFORNIA: FRESNO CO: Near Fresno, 24 Oct 1892, *Davis s.n.* (MICH); Fresno, irrigating ditches, 24 Sep 1892, *Sones 75* (MSC).

MEXICO: SONORA: Sierra Tecurahui, southeastern Sonora, 26–28 Oct 1961, *Gentry et al. 19389* (LL, US). SAN LUIS POTOSI: in paludosis San Miguelito, 1877, *Schaffner 562* (GH). JALISCO: Río Blanco, June 1886, *Palmer 14* (GH, MICH, NY, UC), 8 June 1886, *Palmer s.n.*, (NY, US). MICHOACAN: vicinity of Morelia, 28 Aug 1909, *Arsène 2400* (BM, C, MICH, US), 25 July 1909, *Arsène 2793* (US), 3 Oct 1909, *Arsène 3078* (BM, GH, NY, US), 22 Aug 1909, *Arsène 9894* (US). ESTADO DE MEXICO: 2 km al SE de Tepotzotlán, 8 Oct 1972, *Rzedowski 29492* (CAS). DISTRITO FEDERAL: Valley of Mexico, 12 June 1896, *Pringle 6314* (CAS, ENCB, M, MICH, MO, NY, UC, US); wet places near Mexico City, 24 July 1904, *Pringle 13238* (C, CAS, F, GH, L, MICH, MO, US). HIDALGO: Molango District, Municipality Molango, Lake Atexca, 24 July 1947, *Moore 3468* (GH, MICH, UC, US). VERACRUZ: Jicaltepec, Apr 1841, *Liebmann 14451* (C); near Jalapa, 27 Apr 1899, *Pringle 7814* (GH, US); Puente sobre el Río Jamapa, 15 km al SW of Huatusco, 11 Oct 1964, *Rzedowski 19042* (ENCB).

GUATEMALA: ALTA VERAPAZ: near San Cristóbal, 9 Apr 1939, *Standley 70988* (MICH); Cobán, June 1887, *von Tüerckheim 1262* (GH, MICH, NY, US). BAJA VERAPAZ: about 4 mi S of Salamá, 10 July 1960, *King 3262* (MICH, TEX, UC). JALAPA: between Jalapa and Montaña, 7 Dec 1939, *Steyermark 32854* (F); Potrero Carrillo, at Hierba Buena, 14 mi NE of Jalapa, 11 Dec 1939, *Steyermark 33007* (F).

EL SALVADOR: AHUACHAPAN: Lagunita las Ninjas, Apaneca, 28 Jan 1951, *Fassett 28720* (F). CHALATENANGO: southeast-facing slope of Los Esesmiles, 1 Apr 1942, *Tucker 1190* (F, GH, MICH, NY, UC, US).

HONDURAS: MORAZAN: along Choluteca River near Tegucigalpa, 8 Sep 1946, *Molina R. 10508* (F, MO). OCOTEPEQUE: La Montañita, Cordillera Merendón, 31 Aug 1968, *Molina R. 22581* (F), *22583* (F).

NICARAGUA: JINOTEGA: road to La Fundadora entering at km 142 from Managua, region of Santa María de Ostuma, 7 Dec 1958, *Hawkes et al. 2205* (C, F).

COSTA RICA: CARTAGO: sedge marshes at Moravia de Chirripó, 8 Aug 1968, *Davidse & Pohl 1194* (F, MO). SAN JOSE: vicinity of Santa María de Dota, 14–26 Dec 1925, *Standley 42448* (US); à la hacienda Belmira près Santa María, no date, *Tonduz 11629* (US).

CUBA: CAMAGUEY: thickets not far from lagoon Macurijes Los Salacios, 7 Aug 1917, *Bro. León & Fr. Roca 7356* (NY).

HAITI: OUEST: Bayeux, at mouth of Rivière de Port Margot, north coast, between Cap Haïtien and Le Borne, 19–24 June 1941, *Bartlett 17461* (MICH, US); Plaine du Nord, Haïtien, Morne Rouge, 16 Dec 1924, *Ekman H2914* (US); Mare Etablie, 2 mi W of Morne des Commissaires, 18 Sep 1955, *Proctor 10877* (US).

JAMAICA: Troy, 16 Oct 1917, *Harris 12580* (F, NY).

DOMINICAN REPUBLIC: DISTRITO NACIONAL: Santo Domingo, alto de Casabito, Bonao, 30 Mar 1974, *Liogier 21303* (NY). LA VEGA: Orillas del Río Constanza, en los alrededores de Constanza, 27 Jan 1953, *Jiménez 2556* (US). SAN JUAN: Piedra de Aguacate to Río de Oro, 9 Oct 1946, *Howard & Howard 9387* (BM, GH, MICH, NY, US).

PUERTO RICO: BAYAMON: Bayamón, Nov 1913, *Hioram s.n.* (NY, WTU).

SOUTH AMERICA: COLOMBIA: CUNDINAMARCA: Bogotá, 30 Apr 1944, *Ewan 15585* (NO, UC).

VENEZUELA: LARA: Distrito Jiménez, entre la Encrucijada y el camino al Parque Nacional Yacambú de El Blanquito, SSE de Sanare, 7 Aug 1970, *Steyermark et al. 103556* (NY).

BRAZIL: RIO DE JANEIRO: Rio de Janeiro, Oct 1831, *Riedel 899* (BM, C). RIO GRANDE DO SUL: vicinity of São Leopoldo, Nov 1941, *Leite 468* (NY); Municipio S. Leopoldo, Esteio, Nov 1931, *Orth 678* (MO); Pôrto Alegre, Jan 1933, *Orth 692* (MO). SANTA CATARINA: Rio Castelhanos, 9.1.62, *Reitz & Klein 11856* (UC).

PARAGUAY: MISIONES: Santiago, La Soledad, Isla Carpinche, 27 Dec 1965, *Pedersen 7689* (C, L, NY).

ARGENTINA: CORRIENTES: Depto. General Paz, finca "El Rodeito," 2 Jan 1966, *Krapovickas & Cristóbal 11862* (UC); Depto. Mburucuyá, Estancia "Santa Teresa," 24 Nov 1951, *Pedersen 1341* (C, GH, MO, NY); Depto. Empedrado, Estancia "La Yela," 25 Nov 1957, *Pedersen 4669* (C, MO, NY, UC); Concepción, Fortín del Ibera, 18 Mar 1969, *Pedersen 9067* (C, NY, UC). ENTRE RIOS: Concepción del Uruguay, no date, *Lorentz 139* (B); Federación, Buena Esperanza, 21 Oct 1961, *Pedersen 6234* (A, C, L); Depto. Uruguay, La Selmira, Isla Cupalén, 31 Mar 1967, *Pedersen 8227* (C, L). FORMOSA: Depto. Formosa, 15 km E of Los Matacos, 11 Oct 1938, *Eyerdam & Beetle 22944* (UC); Depto. Pilcomayo, 15 Oct 1946, *Morel 1443* (F). MISIONES: near Eldorado, 22 Jan 1975, *Pedersen 10869* (C). SANTA FE: Depto. Garay, Helvecia, 20 Nov 1946, *Huidobro 3235* (F).

Cyperus virens Michaux var. **drummondii** (Torrey & Hooker) Kükenthal, Pflanzenreich IV. 20 (Heft 101): 181. 1936. Basionym: *Cyperus drummondii* Torrey & Hooker, Ann. Lyceum Nat. Hist. New York 3: 437. 1836. Type: USA, Texas, *Drummond 449* (K!, lectotype; B!, GH!, NY!, isolectotypes). Figure 15 (E–G).

Cyperus robustus Kunth, Enum. Pl. 2: 41. 1837. Type: Brasilia, *Sello s.n.* (B!, holotype).

Cyperus virens Michaux var. *robustus* (Kunth) Kükenthal, Pflanzenreich IV. 20 (Heft 101): 181. 1936.

Cyperus virens Michaux subsp. *drummondii* (Torrey & Hooker) Koyama, Madroño 20: 254. 1970.

Plant usually 25–40 (–rarely to 90) cm tall; leaf sheath 2–10 (–20) cm long; leaf blade 3–5 (–7) mm wide at mid-length; involucral bracts up to 13 (–22) cm long, up to 7 mm wide; primary peduncles 2–5 (–6), up to 2 cm long; secondary peduncles, when present, up to 1.3 cm long; primary heads with 60–70 spikelets, the secondary ones with 7–16 spikelets; bracteoles ca 2 mm long; spikelets 6–13 mm long, 1.5–2.2 (–2.5) mm wide, with 20–40 scales; rachilla with transverse scale scars 0.5–0.6 mm apart on each side; scale angles 45°; scales 1.3–1.6 (–1.8) mm long, 1–1.2 mm wide, or 0.5–0.6 mm wide in lateral view, the proximal abaxial groove between the two keels 0.8 mm long; medial part of scale stramineous and sometimes tinged green, occasionally glaucous; sides of scale light brown to golden brown or reddish brown, basally attached to the rachilla for 0.4 mm; stamens one or two, 1.5–1.9 mm long, the filaments 1.2–1.6 mm long, the anthers ca 0.6 mm long; style ca 0.6 mm long, the stigmatic branches ca 0.4 mm long; achene filling seven-eighths or more of the scale, radially or bilaterally symmetric or asymmetric, reddish brown, brown, or blackish, broadly to narrowly trigonous, obtusely angled, two and one-half to four times longer than wide, 1.1–1.3 mm long (total length), the body 1–1.2 mm long; achenial surfaces usually equal in width, 0.3–0.5 mm wide, sometimes one of the abaxial surfaces 0.1 mm wider than the other two sides, or the adaxial surface wider than the abaxial ones, ovate, the adaxial surface planar, the abaxial surfaces planar or concave on the lower one-half and slightly convex on the upper one-half.

Distribution. Known in North America only from Texas and Louisiana, Nicaragua, and Jamaica, and in South America from the Galapagos Islands, Surinam, and Brazil. In swamps, fern-sedge meadows, open pine woodlands, or *Miconia* forests, from sea level to 700 meters in elevation (Fig. 17).

Discussion. The scales of variety *drummondii* are similar to those of variety *minarum* in that they are apically rounded and often reddish brown on the sides, but differ primarily in size, being smaller than those of any of the other varieties of *C. virens.* The dimensions of the achenes are intermediate between those for variety *virens* and variety *minarum.*

The distribution of variety *drummondii* in three widely separated areas is difficult to explain. At the present time, extinction of intermediate populations appears the most feasible explanation for its disjunctive pattern.

Representative specimens:

UNITED STATES OF AMERICA: LOUISIANA: PLAQUEMINES PARISH: Pointe à la Hache, Abbeville, 28 May 1884, *Langlois 855c* (DS, NY).

TEXAS: HARRIS CO: Houston, 1872, *Hall s.n.* (F). ORANGE CO: 6½ mi W of Orange, 16 Nov 1945, *Cory 50890* (LL).

NICARAGUA: ZELAYA: between Siuna and Limbaikan, 17 Mar 1971, *Svenson 4986* (F).

JAMAICA: Cockpit Country, 13–18 Sep 1906, *Britton 460* (NY).

SOUTH AMERICA: SURINAM: NICKERIE: Sipaliwini savanna area on Brazilian frontier, in Maurisie swamp veg., 3-9-1968, *Oldenburger et al. ON51* (NY).

ECUADOR: GALAPAGOS ISLANDS: CHATHAM ISLAND (I. San Cristóbal): Wrick Bay, 23 Feb 1906, *Stewart 1075* (BISH, MO, NY). INDEFATIGABLE ISLAND (I. Santa Cruz): upper

end of Miconia Forest, 31 Jan 1964, *Fournier 119* (NY); mountain above Fortuna, 21 May 1959, *Harling 5093* (NY); W of Cerro Copa, 6 Feb 1964, *Wiggins 18571* (DS), *18572* (DS); along trail to Mt. Crocker, 6 Feb 1964, *Wiggins 18588* (DS); S slope of Mt. Crocker, 18 Feb 1967, *Wiggins & Porter 680* (CAS, NY).

BRAZIL: BAHIA: Santo Amaro, Rincão dos Mellos, Nov 1922, *Jürgens 24* (B). MINAS GERAIS: Itatiaya, 1200 m, Dec 1892, *Kuntze s.n.* (NY); RORAIMA: Rio Branco, Serra do Banco, Oct 1909, *Ule 8060* (L). SAO PAULO: Rio Tietê, 26 Feb 1905, *Usteri 9371* (NY).

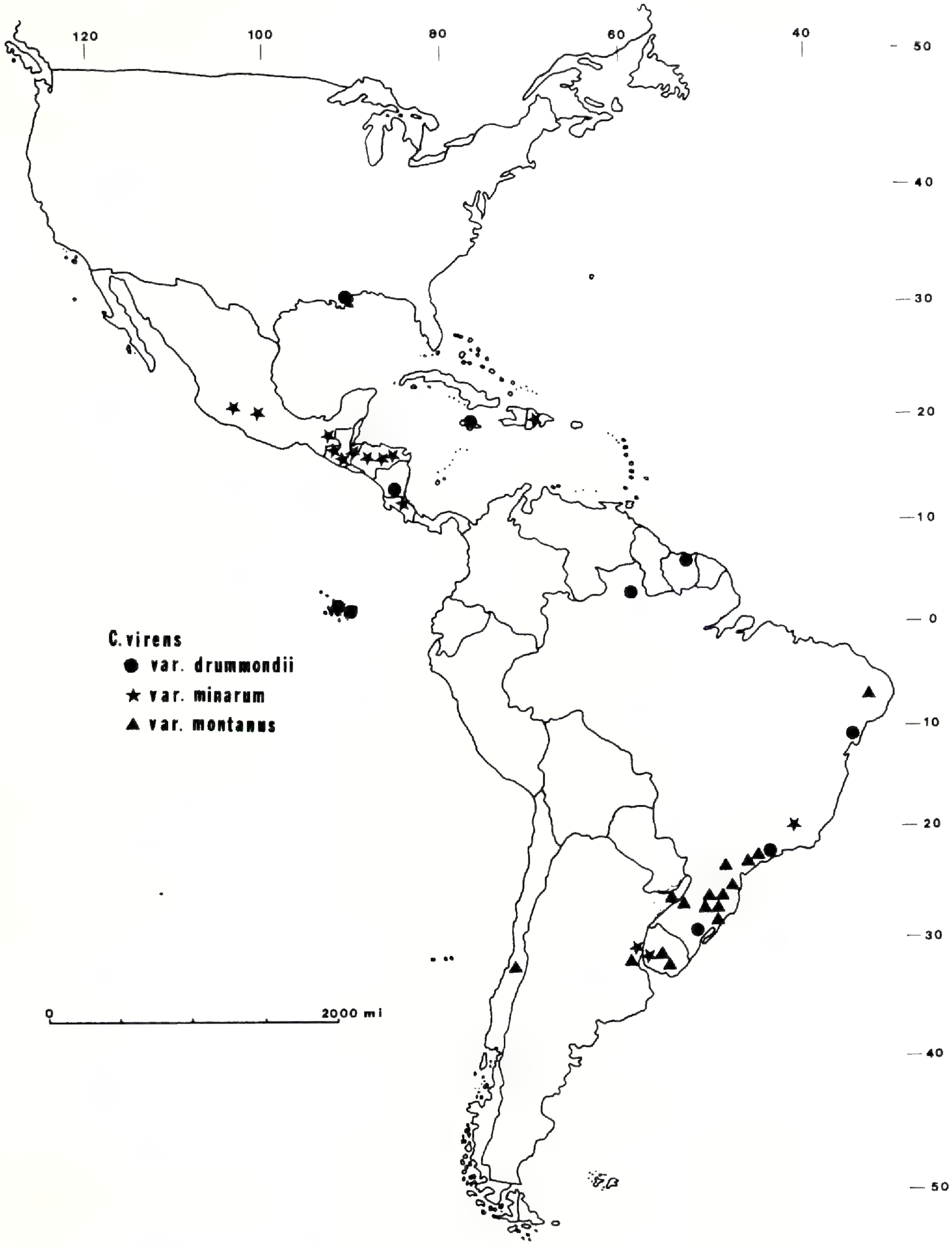

Figure 17. Distribution of *Cyperus virens* var. *drummondii, C. virens* var. *minarum,* and *C. virens* var. *montanus.*

Cyperus virens Michaux var. **minarum** (Böckeler) Denton, comb. nov. Basionym: *Cyperus minarum* Böckeler, Beitr. Cyper. 2: 5. 1890. Type: Brasil, Minas Gerais, 1845, *Widgren s.n.* (C!, isotype; holotype?, not located at B). Figure 15 (H–K).

Cyperus consanguineus *Kunth* var. *minarum* (Böckeler) Kükenthal, Pflanzenreich IV. 20 (Heft 101): 172. 1936.

Plant usually 20–120 cm tall; leaf sheath 4–15 (–21) cm long; leaf blade 6–8 mm wide at mid-length; involucral bracts up to 31 cm long, up to 5 mm wide; primary peduncles 7–10, up to 7 cm long; secondary peduncles absent or 1–7, up to 2 cm long; primary heads with 10–20 spikelets, the secondary ones with 10–14 (–20) spikelets; bracteoles 2–2.5 mm long; spikelets 5–6.5 mm long, 2.2–2.5 mm wide, with 14–18 scales; rachilla with transverse scale scars 0.7 mm apart; scale angles ca 45°; scales 1.5–1.8 (–2) mm long, 1–1.2 mm wide, or 0.5–0.8 mm wide in lateral view, the proximal abaxial groove between the two keels 0.6–0.8 mm long; medial part of scale stramineous or reddish brown; sides of scale reddish brown, or stramineous streaked with red glands, or stramineous, basally attached to the rachilla for 0.3 mm; stamens one or two, 2–2.5 mm long, the filaments 1–1.5 mm long, the anthers 1–1.3 mm long; style 1 mm long, the stigmatic branches ca 0.8 mm long; achene filling two-thirds or more of the scale, radially or bilaterally symmetric or sometimes asymmetric, light brown to brown, broadly trigonous, obtusely angled, two to two and one-half times longer than wide, ca 1.2 mm long (total length), the body ca 1.1 mm long; achenial surfaces equal or unequal in width, 0.5–0.6 mm wide, occasionally one of the abaxial surfaces 0.1–0.2 mm narrower than the other two sides, elliptic, the adaxial surface planar or concave, the abaxial surfaces concave or concave on the lower one-half and convex on the upper one-half.

Distribution. Known from the Dominican Republic, from Chiapas, Mexico, from Guatemala, Honduras, Nicaragua, Costa Rica, and from Minas Gerais, Brazil. Found in montane cloud forests, virgin rainforests on limestone mountains, on heavily forested slopes with *Abies guatemalensis, Podocarpus* and *Quercus* or with *Quercus* and *Magnolia* or with *Quercus* and *Drimys,* cornfields, or in woods on serpentine soils, at elevations from 430 to 3030 meters (Fig. 17).

Discussion. The habit of variety *minarum* is nearly as large as that of variety *virens,* but the plants of variety *minarum* have shorter primary peduncles, fewer scales per spikelets, and broader achenes (two times longer than wide) with larger stipitate bases. The scales are typically rounded distally, rather than distinctly keeled. Young scales tend to be paler and more glaucous than older ones.

Achenes formed in the inflorescences are often abortive, but some normal ones are found. In a specimen from Honduras (*Molina R. 14019*), the compound inflorescence bears normal (fertile) spikelets as well as leafy vegetative shoots.

Representative specimens:

MEXICO: MICHOACAN: vicinity of Morelia, 15 Oct 1909, *Arsène 3118* (MO, US). ESTADO DE MEXICO: "flora del Valle de Mexico," 1875, *Schaffner 3* (NY). CHIAPAS: N edge of San Cristóbal de las Casas, 3 Aug 1964, *Breedlove 6782* (F, NY); Mpio. Tenejapa, along road to San Cristóbal las Casas above Tenejapa Center, 12 July 1965, *Breedlove 10867* (ENCB, F, MICH, NY); Mpio. Amatenango del Valle, 27 July 1966, *Breedlove 14678* (DUKE, ENCB, NY); on boundary between Zinacantán and Chamula along the road to Zinacantán Center, 20 Jan 1965, *Breedlove & Raven 8139* (ENCB, LL, MO); San Cristóbal de las Casas, 12 Apr 1966, *Laughlin 648* (ENCB, NY); Mpio. Tenejapa in Paraje Balum K'anal, 13 Apr 1966, *Ton 850* (ENCB, LL, NY); Mpio. Tenejapa, at the Paraje Matsab, 12 May 1966, *Ton 936* (ENCB, LL, MICH, MO, NY), 28 Sep 1966, *Ton 1265* (DUKE, ENCB, LL, MICH, NY), 28 Sep 1966, *Ton 1295* (DUKE, NY); in the colonia of 'Ach'lum, Mpio. of Tenejapa, 15 May 1967, *Ton 2379* (ENCB, MO).

GUATEMALA: ALTA VERAPAZ: near San Cristóbal, 9 Apr 1939, *Standley 70988* (F, MICH). HUEHUETENANGO: about Laguna de Ocubilá, east of Huehuetenango, 7 Jan 1941, *Standley 82675* (F), *82716* (F). JALAPA: between Miramundo and summit of Montaña

Miramundo, between Jalapa and Mataquescuintla, 6 mi S of Miramundo, 5 Dec 1939, *Steyermark 32661* (F). SANTA ROSA: dried bed of Laguna de Escondita de Tecuamburro, 20 mi S of Barberena, 21 Feb 1951, *Fassett 28912* (F).

EL SALVADOR: CHALATENANGO: southeast-facing slope of Los Esesmiles, 1 Apr 1942, *Tucker 1190* (LL).

HONDURAS: INTIBUCA: 9 kms al E de La Esperanza, 23 May 1964, *Molina & Molina 14019* (BM, F). MORAZAN: matorrales cenagosos en faldas de Montaña Uyuca, 19 July 1963, *Molina R. 12791* (F, NY); Piedra Herrada, lower slopes of Cerro de Uyuca, 7 Aug 1947, *Standley 11925* (F); Las Flores, slopes of Cerro de Uyuca, 25 July 1949, *Standley 21681* (F); western slopes of Cerro de Uyuca, along trail from Las Flores toward Talumbla, 17 Aug 1949, *Standley 22741* (F).

NICARAGUA: MATAGALPA: Cordillera Central de Nicaragua, Finca Sta. María de Ostuma, 18 Jan 1965, *Williams et al. 28002* (F).

COSTA RICA: SAN JOSE: Laguna de la Chanta, 18 Dec 1925, *Standley 42229* (F); Santa María de Dota, Dec 1925, *Standley 42448* (F); Santa María, 27 May 1928, *Stork 2419* (MICH).

DOMINICAN REPUBLIC: INDEPENDENCIA?: limestone mountains of the Sierra de Neiba, along the Haitian border, vicinity line between provinces of San Rafael & Independencia, 4 Aug 1967, *Gastony et al. 521* (GH, NY, US).

SOUTH AMERICA: URUGUAY: RIO NEGRO: Cerro Largo, Palleros, Dec 1937, *Gallinal et al. B2372* (NY).

ARGENTINA: PROVINCIA NOT KNOWN: Depto. Tapenaga, Loc. Enrique Urien, Campo Bonazzola, Nov 1940, *Rodrigo 2503* (NY).

Cyperus virens Michaux var. **montanus** (Böckeler) Denton, comb. nov. Basionym: *Cyperus montanus* Böckeler, Beitr. Cyper. 2: 4. 1890. Type: Argentina, Picada a' San Pedra, Cordillera de Misiones, 29 Oct 1886, *Niederlein 2116* (B!, holotype). Figure 18.

Cyperus uleanus Böckeler, Beitr. Cyper. 2: 5. 1890. Type: Brasil, in gräben am Kleinen Fluss bei Itajahy, *Ule 556* (B!, holotype).

Plant up to 75 cm tall; leaf sheath up to 28 cm long; leaf blade 4–10 mm wide at mid-length; involucral bracts up to 35 cm long, up to 12 mm wide; primary peduncles 7–15, up to 12 cm long; secondary peduncles up to 3 cm long; tertiary peduncles, when present, up to 1 cm long; primary heads with 25–60 spikelets, the secondary ones with 10–50 spikelets, the tertiary ones with 10–15 spikelets; bracteoles 2–5 mm long; spikelets 7–10 mm long, 3–3.6 mm wide, with 14–26 scales; rachilla with transverse scale scars 0.6 mm apart on each side; scale angles 45° (–60°); scales 1.5–1.9 (–2) mm long, 1.1–1.3 mm wide, or 0.4–0.5 (–0.6) mm wide in lateral view, the proximal abaxial groove between the two keels 0.5–0.8 mm long; medial part of scale light green or golden brown with a greenish tinge; sides of scale golden brown, basally attached to the rachilla for 0.2–0.3 mm; stamen solitary, 2–2.3 mm long, the filament ca 1.5 mm long, the anther 0.8 mm long; style 1 mm long, the stigmatic branches ca 0.5 mm long; achene filling one-half to two-thirds of the scale, radially symmetric, brown to brownish black, broadly trigonous, acutely angled, two to two and one-half times longer than wide, 1.1–1.2 mm long (total length), the body 0.8–1 mm long, the stipitate base sometimes slightly enlarged below the constriction; achenial surfaces equal in width, 0.4–0.5 mm wide, obovate or occasionally elliptic or ovate, slightly concave.

Distribution. Variety *montanus* occurs in the southern part of South America, from southern Brazil west to Uruguay, Argentina, and Chile. In wet places along roadsides, streams, or rivers, or around lakes, at elevations from 700 to 950 meters (Fig. 17).

Discussion. Features of the achene easily distinguish variety *montanus* from related taxa. The achenes are broadly trigonous, occupy less than two-thirds of the scales, and have thickened stipes. Vegetatively, variety *montanus* is similar to variety *virens,* but differs by its achenes and by a diffuse compound inflorescence created by primary, secondary, and tertiary peduncles. (The compound inflorescences of all other

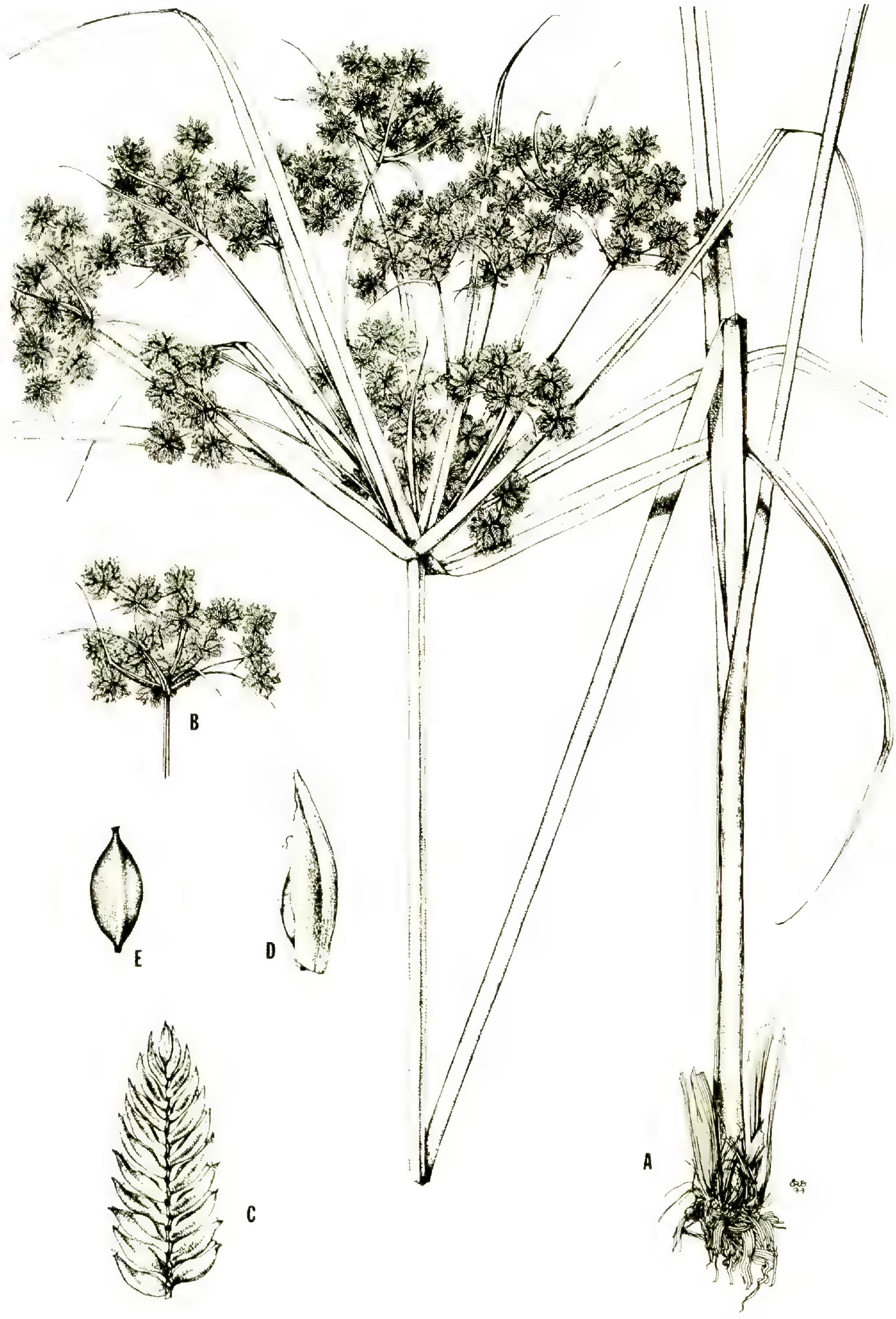

Figure 18. A–E. *Cyperus virens* var. *montanus* (based on specimen from Berlin Herbarium, no. 83, no collector specified, from "Herbar Rudolf Gross"); A, habit, × ½; B, primary peduncle and part of compound inflorescence, × ½; C, spikelet, × 5; D, scale, × 15; E, achene, × 15.

varieties of *C. virens* lack tertiary peduncles.) The most geographically restricted variety of *C. virens,* variety *montanus* is also the least variable morphologically.

Representative specimens:

SOUTH AMERICA: BRAZIL: PARANA: Pinhaes, Piraquara, 1 Mar 1970, *Hatschbach 23956* (C). RIO GRANDE DO SUL: Pôrto Alegre, 2 Nov 1957, *Camargo 2445* (B). SANTA CATARINA: Santa Cecilia, 1 Feb 1962, *Reitz & Klein 11360* (UC); Morro Pinheiro Sêco, Lajes, 17 Dec 1962, *Reitz & Klein 14058* (L); Mun. Papanduva, bog north of Papanduva on the Estrada de Rodagem Federal, 7 Dec 1956, *Smith & Klein 8412* (L); bei Blumenau, Oct 1888, *Ule 962* (B). SAO PAULO: Butantan, 10 Jan 1921, *Gehrt 5406* (GH), *Hoehne 5406* (B).

URUGUAY: CANELONES: Bañados de Canelones, no date, *Caldevilla s.n.* (MICH). SAN JOSE: Barra Sta. Lucía, 11 Mar 1931, *Osten 22189* (GH), 16 Jan 1932, *Osten 22432* (F).

ARGENTINA: MISIONES: Campinas de Americo, 15 Dec 1886, *Niederlein 2060* (B); Cordillera de Misiones, Picada à San Pedro, 29 Oct 1886, *Niederlein 2116* (B).

CHILE: NUBLE: Chillán, 2 Jan 1904, *Elliot 336* (BM).

EXCLUDED OR EXTRALIMITAL NAMES

1. *Cyperus acutangulus* Böckeler, Linnaea 35: 551. 1868. Type: Chile, no locality specified in description, *Chamisso s.n.*; not found. This name may refer to *C. virens* var. *montanus* but positive determination cannot be made from the description. Kükenthal (1936) recognized the name as *C. virens* var. *acutangulus* (Böckeler) Kükenthal.

2. *Cyperus altsonii* Kükenthal, Kew Bull. 1932: 322. 1932. Type: British Guiana, *Altson 492* (NY!, isotype). The spikelets and scales of the type collection are larger than those of the Luzulae group, and the scales have many nerves rather than just three.

3. *Cyperus bakeri* C. B. Clarke, J. Linn. Soc., Bot. 20: 290. 1883. Type: Mauritius, *Gardner s.n.*; not found. The description indicates *C. ochraceus,* but positive identification could not be made.

4. *Cyperus buchananii* Kirk, Trans. & Proc. New Zealand Inst. 10: App. 41. 1878. Type: not located. Kükenthal (1936) synonymized this name with *C. eragrostis* Lamarck.

5. *Cyperus celluloso-reticulatus* Böckeler, Allg. Bot. Z. Syst. 1: 202. 1895. Type: Brazil, in Sümpfen bei Tabarão, Prov. Santa Catarina, Feb 1889, *Ule 1332* (B!, holotype). This species differs from those of the Luzulae group in that the scales are uniformly thin, lacking a thickened middle portion, and the achenes are lenticular and yellow instead of trigonous and brown or black.

6. *Cyperus columbiensis* Palla, Oesterr. Bot. Z. 68: 389. 1908. Type: Colombia, San Cristóbal bei Bogotá, July 1905, *Apollinaire s.n.* (L!, presumably an isotype). The scales of the spikelets of the type collection are somewhat spiral, not two-ranked as in the Luzulae group, and they disarticulate with a small segment of the rachilla, a feature not found in the Luzulae group.

7. *Cyperus compressus* Jacquin, Hort. Bot. Vindob. 3: 10. 1776. Type: not found. The description suggests *C. surinamensis* Rottbøll, especially the collections of *C. surinamensis* made in Jamaica and Puerto Rico.

8. *Cyperus declinatus* Moench, Meth. 317. 1794. Type: not found or mentioned in description. Kükenthal (1936) synonymized this name with *C. eragrostis* Lamarck, but the description alone does not allow positive identification.

9. *Cyperus globuliferus* Link, Jahrb. Gewächsk. 1 (Heft 3): 89. 1820. Type: Not found. The description suggests *C. luzulae* (Linnaeus) Retzius.

10. *Cyperus hieronymi* Böckeler, Beitr. Cyper. 1: 7. 1888. Type: Argentina, Prov. Salta, *Lorentz & Hieronymus s.n.* (B!, holotype). The scales are mostly

five-nerved and are uniformly thin; they are not bicarinate basally as in the Luzulae group. There are three stamens, not the one or two characteristic of the Luzulae group.

11. *Cyperus incomtus* Kunth, Enum. Pl. 2: 39. 1837. Type: Brazil, *Kunth s.n.* (photograph at GH! of holotype located at B). The plants appear most similar to those of taxa currently included in section Glutinosi as defined by Kükenthal (1936); the scales have many nerves and the rachillas are winged.

12. *Cyperus incomtus* Kunth var. *miguelii* Kükenthal, Pflanzenreich IV. 20. (Heft 101): 183. 1936. Type: Bolivia, *Bang 2087* (GH!, MICH!, isotypes). This varietal name is correctly associated with *C. incomtus* Kunth.

13. *Cyperus ochrocephalus* Steudel, Flora 25: 601. 1842. Type: Juan Fernandez Islands, *Bertero 1450* ; not found. The description suggests *C. eragrostis* Lamarck.

14. *Cyperus pauloensis* Palla, Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. 39: 175. 1908. Type: not found.

15. *Cyperus prionotropis* Steudel, Flora 25: 601. 1842. Type: Chile, in sabulosis secus torrentes Taguabagua, *Bertero 314*; not found. The description indicates *C. eragrostis* Lamarck.

16. *Cyperus reflexus* Vahl var. *genuina* forma *evoluta* Osten, Anales Mus. Nac. Montevideo, II. 3: 136. 1931. Type: Uruguay; not found. The description of this form suggests *C. rufescens* (a synonym of *C. reflexus* var. *reflexus*), but positive identification could not be made.

17. *Cyperus reflexus* Vahl var. *genuina* forma *evoluta* Osten subforma *flaccida* Osten, Anales Mus. Nac. Montevideo, II. 3: 136. 1931. Type: Uruguay, Cerro Largo: not found. The description fits *C. reflexus,* but it does not distinguish between the two varieties recognized in this study.

18. *Cyperus reflexus* Vahl var. *genuina* forma *evoluta* Osten subforma *glauco-virens* Osten, Anales Mus. Nac. Montevideo, II. 3: 137. 1931. Uruguay, Depto. de San José, entre Sta. Lucía y Libertad, 28 Feb 1918, *Osten s.n.*; not found. The description fits *C. reflexus,* but it does not distinguish between the two varieties recognized in this study.

19. *Cyperus scaberrimus* Böckeler, Beitr. Cyper. 2: 3. 1890. Type: Brazil, am bache bei Itajahy, Dec 1885, *Ule 558* (B!, holotype). This species does not belong in the Luzulae group because the scales are seven-nerved and glandular adaxially, lack a proximal abaxial groove, and do not readily disarticulate from the rachilla. Kükenthal (1936) treated the name as *C. virens* var. *scaberrimus* (Böckeler) Kükenthal.

20. *Cyperus vegetus* Willdenow var. *obtusangulus* O. Kuntze, Rev. Gen. 3, pt. 2: 334. 1898. Type: not found. The description suggests *C. eragrostis* Lamarck.

21. *Cyperus venturii* Kükenthal, Pflanzenreich IV. 20 (Heft 101): 182. 1936. Type: Argentina, Prov. Tucumán, Barranca Colorada, 15 Feb 1926, *Venturi 4096* (UC!, isotype): The type collection does not belong with the Luzulae group, but is closely allied to section Glutinosi as defined by Kükenthal (1936); the scales are many-nerved and the rachillas winged.

22. *Cyperus virens* Michaux var. *glauco-pallidus* Böckeler, Linnaea 35: 554. 1868. Type: Brazil, no locality specified, *Sello s.n.* (B!, holotype). This species may be of hybrid origin, as suggested by morphological studies, with the putative parents *C. virens* and *C. xanthostachys.* The type specimen does not belong to the Luzulae group because the scales are five-nerved with the margins straight and somewhat erose (similar to *C. xanthostachys*). As in *C. virens,* the stems are triquetrous, and the foliage leaves and involucral bracts are nodulose with transverse septa. With an inflorescence that is mostly immature, the reproductive parts are not readily evident and the gynoecia that are visible are aborted.

23. *Cyperus xanthostachys* Steudel, Flora 35: 600. 1842. Type: not found. If properly interpreted from the description, the plants that belong to this species differ

from those of the Luzulae group in that there are two to three stamens per flower with the filaments one to two times longer than the subtending scale, and the scales appear spirally arranged instead of distichous.

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INDEX TO NAMES USED IN THE LUZULAE GROUP OF CYPERUS

(C = Cyperus; S = Scirpus)

C. acuminatus Torrey & Hooker
C. acuminatus Torrey & Hooker var. *cyrtolepis* (Torrey & Hooker) Kükenthal = *C. acuminatus* Torrey & Hooker
C. arenicola Steudel = *C. pseudovegetus* Steudel var. *pseudovegetus*
C. baazas Steudel = *C. reflexus* var. *reflexus*
C. baenitzii Böckeler = *C. virens* Michaux var. *virens*
C. bangianus Gandoger = *C. luzulae* (Linnaeus) Retzius
C. bipontini Böckeler = *C. surinamensis* Rottbøll
C. calcaratus Nees ex S. Watson & Coulter = *C. pseudovegetus* Steudel var. *pseudovegetus*
C. chamissoi Schrader ex Nees = *C. intricatus* Schrader ex Roemer
C. ciliolatus Böckeler = *C. intricatus* Schrader ex Roemer
C. conoideus L. C. Richard = *C. luzulae* (Linnaeus) Retzius
C. consanguineus Kunth = *C. intricatus* Schrader ex Roemer
C. consanguineus Kunth var. *chamissoi* (Schrader ex Nees) Kükenthal = *C. intricatus* Schrader ex Roemer
C. consanguineus Kunth var. *minarum* (Böckeler) Kükenthal = *C. virens* var. *minarum* (Böckeler) Denton
C. consanguineus Kunth var. *varius* (Böckeler) Kükenthal = *C. intricatus* Schrader ex Roemer
C. cyrtolepis Torrey & Hooker = *C. acuminatus* Torrey & Hooker
C. cyrtolepis Torrey & Hooker var. *arenicola* (Steudel) Böckeler = *C. pseudovegetus* Steudel var. *pseudovegetus*
C. cyrtolepis Torrey & Hooker var. *denticarinatus* (Britton) Britton = *C. acuminatus* Torrey & Hooker
C. denticulatus Schrader ex Roemer & Schultes = *C. surinamensis* Rottbøll
C. distinctus Steudel
C. drummondii Torrey & Hooker = *C. virens* Michaux var. *drummondii* (Torrey & Hooker) Kükenthal
C. entrerianus Böckeler =*C. luzulae* (Linnaeus) Retzius
C. entrerianus Böckeler var *parvicapitatulatus* Kükenthal = *C. luzulae* (Linnaeus) Retzius
C. eragrostis Lamarck
C. eragrostis Lamarck forma *latifrons* Kükenthal =*C. eragrostis* Lamarck
C. eragrostis Lamarck forma *tener* Kükenthal = *C. eragrostis* Lamarck
C. eragrostis var. *compactus* (Desvaux) Kükenthal = *C. eragrostis* Lamarck
C. formosus Vahl = *C. virens* Michaux var. *virens*
C. fraternus Kunth = *C. reflexus* Vahl var. *fraternus* (Kunth) Kuntze
C. guatemalensis Gandoger = *C. luzulae* (Linnaeus) Retzius
C. haemostachys Steudel = *C. reflexus* Vahl var. *reflexus*
C. intricatus Schrader ex Roemer
C. longicaulis Böckeler = *C. intricatus* Schrader ex Roemer
C. luzulae (Linnaeus) Retzius
C. luzulae (Linnaeus) Retzius forma *pallidiflorens* Kükenthal = *C. luzulae* (Linnaeus) Retzius
C. luzulae (Linnaeus) Retzius var. *entrerianus* (Böckeler) M. Barros = *C. luzulae* (Linnaeus) Retzius
C. luzulae (Linnaeus) Retzius var. *minor* Böckeler = *C. luzulae* (Linnaeus) Retzius
C. luzulae (Linnaeus) Retzius var. *tucumanensis* (Böckeler) C. B. Clarke = *C. luzulae* (Linnaeus) Retzius
C. luzulae (Linnaeus) Retzius var. *umbellulatus* Britton = *C. pseudovegetus* Steudel var. *pseudovegetus*
C. minarum Böckeler = *C. virens* Michaux var. *minarum* (Böckeler) Denton
C. monandrus Roth = *C. eragrostis* Lamarck
C. montanus Böckeler = *C. virens* Michaux var. *montanus* (Böckeler) Denton
C. ochraceus Vahl

C. ochraceus Vahl var. *excelsior* Kükenthal = *C. ochraceus* Vahl
C. ochraceus Vahl var. *minor* Kükenthal = *C. ochraceus* Vahl
C. pseudosurinamensis Böckeler = *C. luzulae* (Linnaeus) Retzius
C. pseudovegetus Steudel var. *arenicola* (Steudel) Kükenthal = *C. pseudovegetus* Steudel var. *pseudovegetus*
C. pseudovegetus Steudel var. *megalanthus* Kükenthal
C. pseudovegetus Steudel var. *pseudovegetus*
C. reflexus Vahl var. *fraternus* (Kunth) Kuntze
C. reflexus Vahl var. *intricatus* (Schrader ex Roemer) Kükenthal = *C. intricatus* Schrader ex Roemer
C. reflexus Vahl var. *macrostachys* Böckeler = *C. reflexus* Vahl var. *reflexus*
C. reflexus Vahl var. *reflexus*
C. robustus Kunth = *C. virens* Michaux var. *drummondii* (Torrey & Hooker) Kükenthal
C. rufescens Torrey & Hooker = *C. reflexus* Vahl var. *reflexus*
C. rufescens Torrey & Hooker var. *denticarinatus* Britton = *C. acuminatus* Torrey & Hooker
C. schenkianus Böckeler = *C. intricatus* Schrader ex Roemer
C. sellowii Link = *C. reflexus* Vahl var. *reflexus*
C. serrulatus S. Watson = *C. eragrostis* Lamarck
C. sphaerostachys Link = *C. luzulae* (Linnaeus) Retzius
C. subenervius Steudel = *C. surinamensis* Rottbøll
C. surinamensis Rottbøll
C. surinamensis Rottbøll var. *formosus* (Vahl) Kükenthal = *C. virens* Michaux var. *virens*
C. surinamensis Rottbøll var. *lutescens* Böckeler = *C. surinamensis* Rottbøll
C. surinamensis Rottbøll var. *strictus* Kükenthal = *C. reflexus* Vahl var. *fraternus* (Kunth) Kuntze
C. surinamensis Rottbøll var. *viridis* Böckeler = *C. surinamensis* Rottbøll
C. trinitatis Steudel = *C. luzulae* (Linnaeus) Retzius
C. tucumanensis Böckeler = *C. luzulae* (Linnaeus) Retzius
C. uleanus Böckeler = *C. virens* Michaux var. *montanus* (Böckeler) Denton
C. usteri Palla = *C. intricatus* Schrader ex Roemer
C. varius Böckeler = *C. intricatus* Schrader ex Nees
C. vegetus Willdenow = *C. eragrostis* Lamarck
C. vegetus Willdenow var. *compactus* Desvaux = *C. eragrostis* Lamarck
C. vegetus Willdenow var. *triangularis* Böckeler = *C. eragrostis* Lamarck
C. vegetus Willdenow var. *trigonus* Kuntze = *C. eragrostis* Lamarck
C. virens Michaux subsp. *drummondii* (Torrey & Hooker) Kükenthal = *C. virens* Michaux var. *drummondii* (Torrey & Hooker) Kükenthal
C. virens Michaux var. *arenicola* (Steudel) Shinners = *C. pseudovegetus* Steudel var. *pseudovegetus*
C. virens Michaux var. *brittonii* C. B. Clarke = *C. distinctus* Steudel
C. virens Michaux var. *drummondii* (Torrey & Hooker) Kükenthal
C. virens Michaux var. *minarum* (Böckeler) Denton
C. virens Michaux var. *montanus* (Böckeler) Denton
C. virens Michaux var. *robustus* (Kunth) Kükenthal = *C. virens* Michaux var. *drummondii* (Torrey & Hooker) Kükenthal
C. virens Michaux var. *virens*
C. virens Michaux var. *widgrenii* (Böckeler) C. B. Clarke ex M. Barros = *C. intricatus* Schrader ex Roemer
C. widgrenii Böckeler = *C. intricatus* Schrader ex Nees
S. luzulae Linnaeus = *C. luzulae* (Linnaeus) Retzius

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Previous numbers of the *Contributions* are listed at the end of this issue. For information address the Director, University of Michigan Herbarium, Ann Arbor, Michigan 48109, U.S.A.

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TWO NEW SPECIES OF BUNCHOSIA FROM WESTERN MEXICO

William R. Anderson
University of Michigan

The genus *Bunchosia* is taxonomically one of the most difficult in the Malpighiaceae and it is not without some trepidation that I venture to describe new species in the group. However, the two species described here seem to be morphologically distinct and geographically disjunct from their closest relatives, which grow in southeastern Mexico and adjacent Guatemala.

Bunchosia mcvaughii W. R. Anderson sp. nov. Fig. 1.

Arbor parva usque 4 m alta, ramis vegetativis sericeis mox glabratis. Lamina foliorum majorum 8–15 cm longa, 2.2–5 cm lata, anguste elliptica vel ovata, basi cuneata vel rotundata, margine saepe crispata, apice acuminata vel rarius acuta vel obtusa, matura supra glabrata, subtus lanata, pilis tenuibus pro parte maxima valde tortuosis aliquot rectis adpressisque pede 0.2 mm longo trabecula usque 2 mm longa, subtus plerumque (non semper) prope basin 2 glandulis et distaliter utrinque sub margine vel inter marginem et costam 1–4 glandulis instructa; petiolus 5–8 mm longus, pertinaciter laxe sericeus vel glabrescens, eglandulosus; stipulae 1–1.5 mm longae, basi petioli portatae. Inflorescentia par pseudoracemorum plerumque terminalis, quoque pseudoracemo 5–10 cm longo, sine foliis vegetativis, laxe sericeo, 8–18 floribus patentibus dispersis saepe decussatis, bracteis 1.5–2.5 (–3) mm longis, triangularibus, tomentosis, persistentibus, eglandulosis, pedunculo nullo vel raro usque 1.5 mm longo, bracteolis 1–2 (–2.5) mm longis, ovatis, ambabus glandula abaxiali excentrica instructis. Pedicellus 6–12 mm longus, laxe et pertinaciter sericeus. Sepala glandulas 2.5–3 mm superantia, 1.5–2.5 mm lata, ovata, abaxialiter sericea vel prope marginem ciliatam glabra, adaxialiter glabra, glandulis 8, 2.5–4 mm longis, ellipicis, distinctis vel in paribus partim connatis, aliquot interdum decurrentibus. Petala flava, glabra, eglandulosa, 4 lateralia reflexa, ungue 2.5–3.5 (–4.5) mm longo, limbo 6–10 mm longo, 5–9 mm lato, eroso, 2 anterioribus quam 2 posterioribus majoribus et profundius concavis; petalum posticum erectum, ungue 3.8–4.5 mm longo, crassissimo, limbo 7 mm longo et 5–6 mm lato, eroso, plano. Filamenta 2.5–3.5 mm longa, glabra, ca 1/3 connata; antherae 1.5–2.2 (–2.5) mm longae, glabrae, connectivo primo rubro-brunneo demum ligno-brunneo, loculis basi pendentibus; pollen globosum, 38–50 μ diametro, 8–9-foratum. Ovarium 2.5–3 mm altum, bicarpellatum, sericeum; styli 2.5–3 mm longi, omnino connati vel apice liberi, glabri vel raro tomentosi, stigmate peltato. Fructus ignotus.

TYPE: MEXICO. Jalisco: "Centro de Investigación y Experimentación de la UNAM," 8 km E of Chamela, lowland forest of *Cordia, Caesalpinia, Thouinidium,* elev 30–50 m, abundant in dense forest shade, 8–10 Dec 1970 flr, *McVaugh 25107* (MICH, holotype).

PARATYPES: MEXICO. Jalisco: Steep forested hills 2–6 km SE of La Manzanilla, above Bahía Tenacatita on the new road to Melaque, with *Brosimum, Orbignya, Hura, Bursera, Cordia,*

elev 200 m or less, locally abundant in deep shady ravine, 6 Dec 1970 flr, *McVaugh 25055* (MICH); mountains 12–15 miles SSE of Autlán, on lumber road to Corralitos, 4–10 miles above (SE of) Ahuacapán, in pine forest zone, elev ca 1500–2200 m, 22–23 Nov 1959 flr, *McVaugh & Koelz 954* (MICH); stream valley crossing the highway to Autlán, 9 miles N of the road junction at the W end of Bahía de Navidad; steep moist ravines, in rich soil, the forest dominated by *Orbignya, Hura, Brosimum,* elev 300 m, 12–13 Dec 1959 flr, *McVaugh & Koelz 1769* (MICH). Colima: Low mountain summits 7 miles N of Santiago, on the road to Durazno, Jalisco; deciduous woodlands, with *Cordia, Brosimum, Platymiscium,* elev 200 m, 10 Dec 1959 flr, *McVaugh & Koelz 1663* (MICH).

This species is named in honor of Rogers McVaugh, eminent student of Mexican botany. Its distinctive features will be discussed below.

Bunchosia praecox W. R. Anderson sp. nov. Fig. 1.

Frutex vel arbor 2–6 m alta, ramis vegetativis glabratis. Folia ignota, floribus et fructibus in ramis sine foliis portatis. Inflorescentia plerumque par pseudoracemorum, terminalis vel axillaris, quoque pseudoracemo 0.8–2.5 (–3.5) cm longo, sine foliis vegetativis, sericeo vel dense tomentoso, 3–6 (–8) floribus plerumque decussatis, bracteis 3–3.5 mm longis, triangularibus, sericeis, persistentibus, eglandulosis, pedunculo nullo, bracteolis 2–3 mm longis, ovatis, ambabus (vel interdum tantum una) glandula abaxiali excentrica instructis. Pedicellus 2–3 mm longus (–4 mm fructu), laxe sericeus vel tomentosus. Sepala glandulas ca 2 mm superantia, ca 1.5 mm lata, triangularia, abaxialiter sericea, adaxialiter glabra, glandulis 8, 1.8–2.5 mm longis, obovatis, distinctis. Petala flava, glabra, eglandulosa vel raro quintum basi 1–2 glandulis parvis instructum, 4 lateralia reflexa, ungue 1.5–2 mm longo, limbo 4–6 mm longo, 3–5 mm lato, eroso vel dentato, 2 anterioribus quam 2 posterioribus majoribus et profundius concavis; petalum posticum erectum, ungue 3 mm longo, crasso, limbo 3–3.5 mm longo, 2–3 mm lato, subintegro, plano. Filamenta 2–3 mm longa, glabra, ca 1/3 connata; antherae 1–1.3 mm longae, glabrae, connectivo brunneo demum flavo; pollen globosum, 31–36 μ diametro, 6–7 (–8)-foratum. Ovarium 1.2–1.5 mm altum, bicarpellatum, sericeum; stylus (ex 2 stylis omnino connatis) 2–2.2 mm longus, tomentosus, stigmate bilobo. Fructus aurantiacus, siccus 11 mm longus, 16 mm latus, didymus lobis globosis, laxe sericeus.

TYPE: MEXICO. Jalisco: Along the road from Barra de Navidad to Tequezquitlán, Concepción, and Autlán; grassland with scattered oaks, 15 road-miles N of Navidad, elev 375 m, locally abundant, 8 Apr 1951 flr & frt, *McVaugh 11895* (MICH, holotype).

PARATYPE: MEXICO: Sinaloa: Tropical deciduous forest, *Haematoxylon, Guazuma, Ipomoea, Pachycereus,* and *Pseudobombax,* about 30 miles E of Culiacán along road between Presa López Mateos and Tamazula, Durango, elev 400 m, 18 Mar 1972 flr, *Breedlove 24459* (MICH).

In the taxonomy of Niedenzu (1928), *Bunchosia mcvaughii* and *B. praecox* would be placed in section *Eriothrix* subsection *Eremadenia,* which contains *Bunchosia biocellata* and its close relatives, none of them known from western Mexico. The new species both differ from the rest of the subsection in having both bracteoles of each flower usually glanduliferous. *Bunchosia mcvaughii* is further distinguished by its long narrow leaves, long divergent pedicels, and large flowers, while *B. praecox* is notable for its very short, stout pedicels and its habit of flowering when it is leafless, to which the epithet refers. *Bunchosia mcvaughii* seems to grow in wetter, more wooded habitats than *B. praecox.* The following key distinguishes the new species from each other and from the commonest species of western Mexico, *Bunchosia palmeri* S. Watson, all three having the leaves woolly or tomentose below.

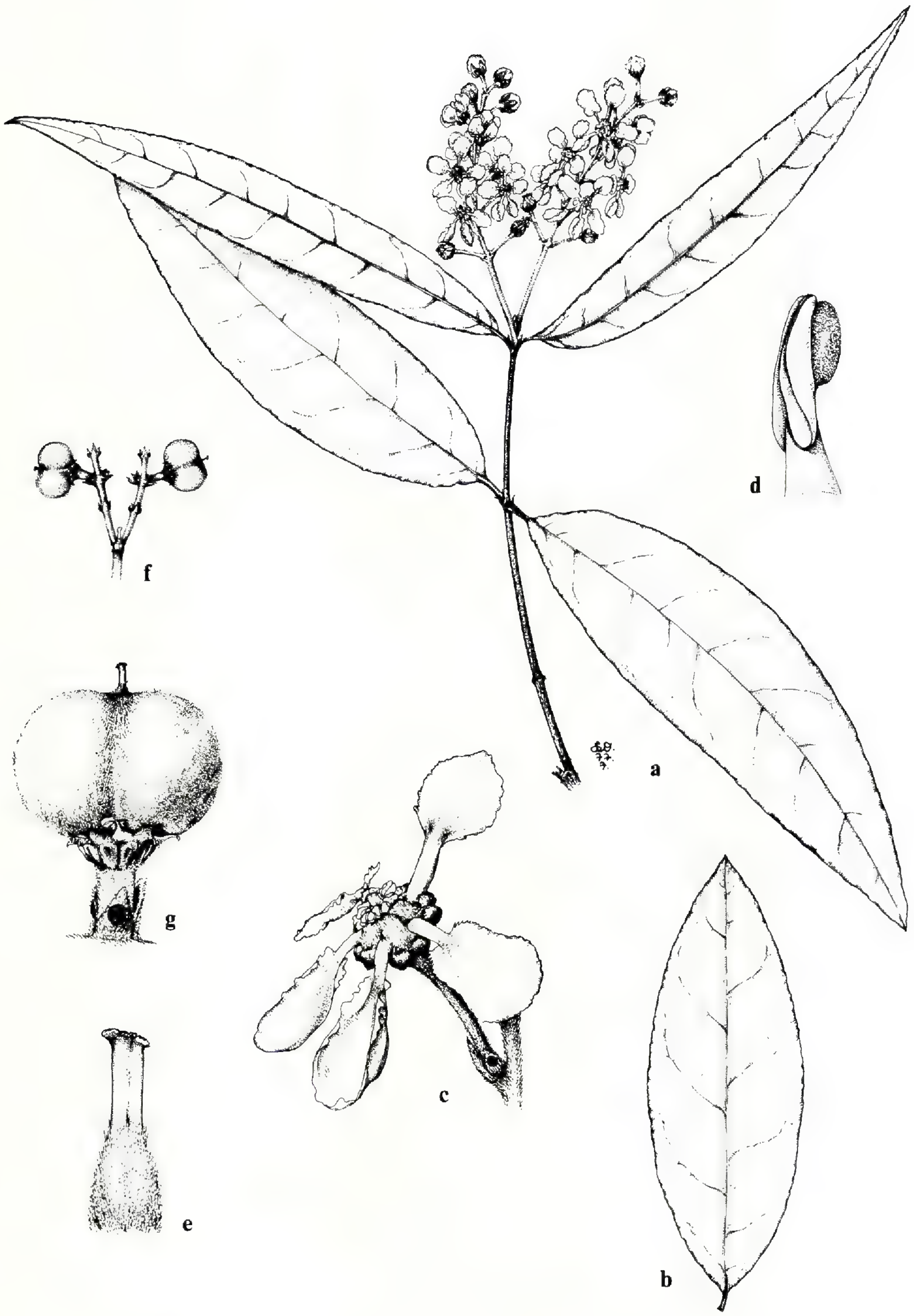

FIG. 1. *Bunchosia mcvaughii* and *B. praecox*. a–e, *B. mcvaughii*: a) flowering branch, × 0.5; b) shorter leaf, same collection, × 0.5; c) flower, × 2; d) stamen, × 10; e) gynoecium, × 5. f-g, *B. praecox*: f) infructescence, × 0.5; g) fruit, × 2. Drawn from the types by Karin Douthit.

1. Ovary (not style) glabrous; only 1 of each pair of bracteoles glanduliferous; sepals glabrous or at most ciliate on the margin. *B. palmeri.*
1. Ovary densely sericeous; both bracteoles usually glanduliferous; sepals abaxially sericeous.
   2. Plants leafy when flowering; pseudoraceme 5–10 cm long, with 8–18 flowers; pedicel 6–12 mm long; calyx glands 2.5–4 mm long, often partly connate in pairs; limb of the lateral petals 6–10 mm long; anthers 1.5–2.2 (–2.5) mm long. *B. mcvaughii.*
   2. Plants leafless when flowering; pseudoraceme 0.8–2.5 (–3.5) cm long, with 3–6 (–8) flowers; pedicel 2–3 mm long (–4 mm in fruit); calyx glands 1.8–2.5 mm long, distinct; limb of the lateral petals 4–6 mm long; anthers 1–1.3 mm long *B. praecox.*

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Contr. Univ. Mich. Herb. 11(5):277–280. 1978.

KOSTELETZKYA TUBIFLORA (MALVACEAE): A NEW NAME BASED ON A SESSE & MOCINO PAINTING

Orland J. Blanchard, Jr. and Rogers McVaugh
Purdue University and University of Michigan

Within the genus *Kosteletzkya* Presl (Malvaceae) a few taxa from western Mexico which together comprise the section *Orthopetalum* Benth. are unique in having convolute, tubular corollas and strongly exserted staminal columns and styles. The most common of these species, *K. paniculata* Benth., must now be known under a new name as a result of the identification of the type of *Hibiscus tubiflorus* DC.

A. P. de Candolle (1824) described *H. tubiflorus* from a painting made during the Sessé and Mociño botanical expeditions in Mexico (Fig. 1). Unlike many of the *Icones Florae Mexicanae* in the de Candolle collection at Geneva, this painting, no. 83, is an original, not a copy (cf. A. de Candolle, 1874). It bears the original plate number (316) which was cited (under the name of *Hibiscus vitifolius* [Linnaeus]) in Sessé & Mociño's *Plantae Novae Hispaniae,* p. 112 (1889) and in ed. 2, p. 105 (1893). As was often the case in this work, the authors erroneously identified the Mexican plant with an Old-World Linnaean species. Nonetheless, the description provides important additional details about *Hibiscus tubiflorus.*

Among the tube-flowered Mexican Malvaceae, only the species in *Kosteletzkya* sect. *Orthopetalum* agree with the figure of *H. tubiflorus* in combining a depressed, 5-angled capsule with glabrous seeds and five style-branches. *Hibiscus spiralis* Cav., which is apparently endemic to the mountains immediately around Mexico City, differs from the figure in having an ovate capsule and hairy seeds. The various species of *Malvaviscus* differ in having ten style-branches and auriculate petals.

Within section *Orthopetalum* the species *K. paniculata* conforms most closely to the figure and descriptions in its general aspect and its hispid pubescence. This species (including *K. hibiscifolia* Standl.) extends from central Sinaloa and southern Durango southeastward to the western parts of the states of México and Guerrero (Fig. 2).[1] The three other names in section *Orthopetalum, K. madrensis* M. E. Jones, *K. thurberi* A. Gray and *K. malvaviscana* Rose, are typified by plants from further northwest in the canyons bordering the Sonoran Desert in Sonora and adjacent Chihuahua (Fig. 2). These three taxa, which probably represent a single species, differ from *K. paniculata* and both the painting and descriptions of *H. tubiflorus* in having fewer flowered, leafier inflorescences and shorter, mostly stellate pubescence.

Since these two distributions are separate, it was possible for us further to confirm the identity of *H. tubiflorus* by pinpointing the locality "in Mexici montibus Sancti-Hieronimi" cited by A. P. de Candolle. In the *Plantae Novae Hispaniae* the town

[1]Collections of this species at P are labelled as having been collected in Oaxaca by Ghiesbreght, but this may be questioned, as some of this collector's specimens supposedly from Oaxaca are known to have been erroneously labelled (cf. McVaugh, 1972). One specimen at P bears the statement "croit a Arumbaro." There is a locality called Arúmbaro in northwestern Michoacán, about 35 km southwest of Zamora. Little is known about the details of Ghiesbreght's travels in western Mexico, but there are existing specimens credibly labelled as having been taken by him near the Nevado de Toluca, near Apatzingán, and near Colima. It is not impossible that he passed through Arúmbaro. Galeotti, a collector who knew Ghiesbreght and on occasion travelled with him, also visited Arúmbaro, which he located in Michoacán, "à 3,000 pieds" (Bull. Acad. Brux. 9, pt. 2: 385. 1842). In any event Mexican place-names ending in "-aro" are characteristic of northern Michoacán and adjacent Guanajuato and México, in an area well within the range of *K. tubiflora.*

FIG. 1. Type of *Hibiscus tubiflorus* DC. (Ic. Fl. Mex. 316 of Sessé & Mociño; plate 83 of the de Candolle collection at G-DC). Reproduced from Field Museum negative no. 30504.

of San Gerónimo ("oppidum Sancti Hieronymi") is said to be near Chilapa, [Guerrero], where the Botanical Expedition worked in 1789 during September, the month when "*Hibiscus vitifolius*" was said to be in flower (McVaugh, 1977). A list of the paintings (mss., MA) made during the so-called "Second Excursion," that to Guerrero in 1789, includes no. 316, under the name of *Hibiscus vitifolius,* thus strengthening the assumption that the locality in Guerrero is the one cited by de Candolle. San Gerónimo not only lies far to the southeast of the range of the Sonoran representatives of *Kosteletzkya* sect. *Orthopetalum,* but also more than 150 km

FIG. 2. Known distributions of taxa of *Kosteletzkya* sect. *Orthopetalum* in western Mexico. Dots, *K. paniculata.* Triangles, composite distribution of *K. thurberi, K. madrensis* and *K. malvaviscana.* Star, *Hibiscus tubiflorus.* Distributions, except for *H. tubiflorus,* based on specimens examined at A, BH, CU, F, GH, MICH, MO, NY, US.

southeast of the nearest known localities for *K. paniculata* in Guerrero and México (Fig. 2). The Chilapa locality, however, is geographically a logical extension of the known range of *K. paniculata.* A rather surprisingly large number of species reported by Sessé & Mociño from Guerrero remained lost or not surely known until they were discovered through specific searches in recent years near Chilpancingo, Chilapa, Mazatlán, Acahuizotla, and other places near the route of the expedition. One example of this, also in the Malvaceae, is *Anotea flavida* (DC.) Ulbr. (Fryxell, 1968).

It is fortunate that the nearly inaccessible mountains of Michoacán, western Guerrero and southern México were carefully collected by G. B. Hinton. Without his eight collections of *K. paniculata* the gap between the Sessé and Mociño plant and the closest known neighboring population would be doubled to more than 300 km and might have cast some doubt on the identity of *H. tubiflorus.* As it now stands, the hiatus between the Chilapa locality and the nearest Hinton collection is no greater than between some populations in the northwestern part of the species' range. Undoubtedly

as the mountains of western and southern Mexico become more accessible to botanists, these gaps will be filled in.

The flower color of *H. tubiflorus* is consistent with its presumed eastern position within the range of *K. paniculata.* Sessé and Mociño described the flowers as pink ("pallide rubri") and A. P. de Candolle called them red, tinged with yellow ("ex flavo-rubra"). The most common color noted in *K. paniculata* by collectors is yellow, the pinks apparently being confined to that half of the species' range south and southeast of Lago de Chapala, and hence among the nearest known populations to the San Gerónimo locality.

Kosteletzkya tubiflora (DC.) O. Blanchard & McVaugh, comb. nov. *Hibiscus tubiflorus* DC. Prodr. 1: 447. 1824. Type: Plate 83 of the de Candolle Collection (G-DC; cf. A. de Candolle, 1874), constituting Ic. Fl. Mex. 316 of Sessé & Mociño.

There is a specimen (sheet no. 3563) in the Sessé & Mociño herbarium at Madrid labelled *Hibiscus vitifolius,* and another at BM (ex herb. Lambert ex Pavón ex Sessé & Mociño) labelled "*Hibiscus vitifolius* de Mexico." Both of these are *Kosteletzkya tubiflora.* Probably the specimen at MA should be regarded as the typotype. Sessé & Mociño, as far as we know, did not attempt to secure herbarium material of every species from different localities, instead concentrating upon the search for species never before described, painted, and collected. We suppose the herbarium material of "*Hibiscus vitifolius*" may have been collected at the same time the painting was made, but in the absence of locality-data on the specimens themselves we cannot prove this. In the *Plantae Novae Hispaniae,* Sessé & Mociño cited no definite locality for *Hibiscus vitifolius.*

On the few occasions when *H. tubiflorus* was dealt with by subsequent authors it was placed among, or in synonymy with species in *Hibiscus* sect. *Bombicella,* near *H. pilosus* (Swartz) Fawc. & Rendle (Gray, 1897; Hochreutiner, 1900; Standley, 1923); or it was identified with *H. clypeatus* L. (Millspaugh, 1895; cf. Blanchard, 1976). In identifying this plant with *H. vitifolius* L., Sessé and Mociño reflected the often noted similarity of *Kosteletzkya* to species in *Hibiscus* sect. *Pterocarpus* Garcke. Indeed Mattei (1917) described a new genus *Fioria* to accommodate *H. vitifolius* and a few related Old-World *Hibiscus* species, stating that *Fioria* was intermediate between *Hibiscus* and *Kosteletzkya.* Recent evidence has shown that the genus *Kosteletzkya* is cytologically distinct from *Fioria* (Blanchard, 1974).

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SPHAGNUM RICHARDSIANUM, A NEW SPECIES FROM MEXICO

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Through the courtesy of A. J. Sharp of the University of Tennessee, I have been able to study a goodly number of collections of *Sphagnum* from the Sierra de Juárez in the state of Oaxaca in eastern Mexico. Among them were found specimens of *Sphagnum tenellum* Ehrh. *ex* Hoffm., reported elsewhere (Crum, 1975) as a range extension of considerable interest, as well as three collections of an interesting *Sphagnum* new to science, described below.

Sphagnum richardsianum Crum, sp. nov. Figs. 1–5.

Plantae graciles, molles, glauco-virides vel apice flavo-fuscae. Hyalodermis caulis stratis 1–2, sine poris. Folia caulina 1.6–2.2 mm longa, plus minus concava, late oblongo-ovata, apice late rotundato-truncata dentataque, anguste limbata, ad basim multifibrosa; cellulae hyalinae raro septatae, utroque latere foliorum superiore parte poris minutis paucis in cellularum angulis, saepe pseudoporis in series breves ad commissuras instructae. Fasciculi ramorum ramis 3. Folia ramulina 1.5–2 mm longa, valde concava, ovata, apice rotundato-truncata, dentata, marginibus anguste limbatis, late incurvatis; cellulae hyalinae multifibrosae, raro septatae, exteriore folii superficie poris minutissimis paucis in angulis cellularum et ad commissuras et pseudoporis in series breves ad commissuras instructae, superficie interiore pauci- vel aporosae; cellulae chlorophylliferae sectione transversali rectangulares, utroque latere foliorum liberae.

Plants relatively small, soft, pale, green or yellowish, sometimes orange-brown above. Cortical cells of stem moderately differentiated in 2 layers, short-rectangular, 2–3:1, without pores or fibrils. Stem and branch leaves essentially isomorphous: Stem leaves somewhat concave, 1.6–2.2 mm long, ovate-elliptic, broadly rounded to truncate at the apex, bordered by 2–3 rows of linear cells, entire except for coarse dentations across the apex; hyaline cells fibrillose throughout, not or rarely 1-divided, on the outer surface near the leaf apex with 3–6 very small, rounded, unringed pores, mostly at corners and often few to numerous, sometimes crowded pseudopores, in the lower part of the leaf with 1–4 small, rounded pores at or near the corners and no pseudopores, on the inner surface near the apex with a few small, rounded, unringed pores or pseudopores at the corners and elsewhere along the commissures, in the lower portions with 1–5 small, rounded-elliptic pores mainly at the corners, very numerous along the commissures at the basal margins of the leaf. Branches in fascicles of 3 (2 spreading and 1 pendent or 1 spreading, 1 ± deflexed and tapered, and 1 clearly pendent); cortical cells in 1 layer, the retort cells with inconspicuous necks. Branch leaves deeply concave when moist, less so when dry, erect or erect-spreading, not at all secund, 1.5–2 mm long, ovate, bordered by 2–3 rows of linear cells, dentate across the apex; hyaline cells bulging on both surfaces, fibrillose throughout, undivided or in some leaves occasional cells repeatedly divided lengthwise, on the outer surface near the apex with 1–7 small, rounded-elliptic, ± ringed pores at the corners or scattered

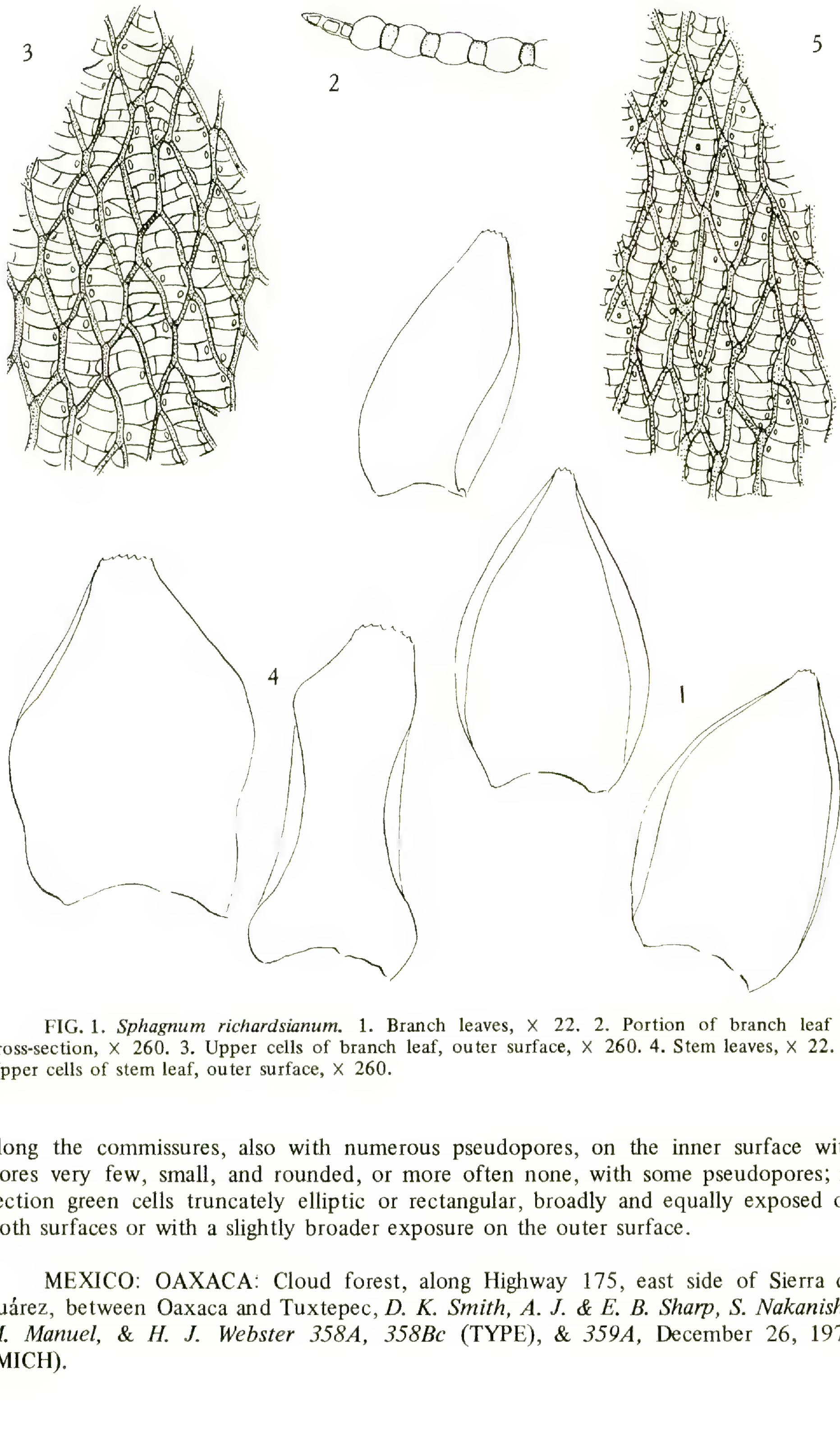

FIG. 1. *Sphagnum richardsianum.* 1. Branch leaves, × 22. 2. Portion of branch leaf in cross-section, × 260. 3. Upper cells of branch leaf, outer surface, × 260. 4. Stem leaves, × 22. 5. Upper cells of stem leaf, outer surface, × 260.

along the commissures, also with numerous pseudopores, on the inner surface with pores very few, small, and rounded, or more often none, with some pseudopores; in section green cells truncately elliptic or rectangular, broadly and equally exposed on both surfaces or with a slightly broader exposure on the outer surface.

MEXICO: OAXACA: Cloud forest, along Highway 175, east side of Sierra de Juárez, between Oaxaca and Tuxtepec, *D. K. Smith, A. J. & E. B. Sharp, S. Nakanishi, M. Manuel, & H. J. Webster 358A, 358Bc* (TYPE), & *359A,* December 26, 1970 (MICH).

Outstanding features of this species include, first and foremost, the essentially isomorphous nature of stem and branch leaves. The stem leaves are broadly ovate-elliptic, somewhat concave, and broadly truncate or more or less rounded at a dentate apex. The margins are bordered by linear cells. the hyaline cells are fibrillose throughout. The pores are few and very small, but in the upper part of the leaf, on the outer surface, pseudopores may be quite numerous and sometimes crowded in commissural rows. The branch leaves are somewhat smaller, ovate, and deeply concave. The concavity obscures the fact that the apex is broad. The hyaline cells have rather few pseudopores even near the apex, although they are sometimes rather numerous.

The orange-brown coloration, the more or less equal exposure of green cells of branch leaves, and the occurrence of pseudopores in something of a beaded arrangement make a placement in the section Subsecunda possible. Because of leaves broadly pointed at the apex and not particularly concave when dry, there is some superficial likeness to *S. fitzgeraldii* of the section *Cuspidata,* a resemblance that is made more striking by the fact that pores are few (as in many of the *Cuspidata*). The true relationships may be found in the flora of southeastern Africa and Madagascar and Mauritius. Judging by Warnstorf's descriptions in the *Sphagnologia Universalis, S. oxycladum* Warnst. and its var. *mauritianum* (Warnst.) Warnst. and also *S. transvaaliense* C. M. *ex* Warnst. have similarly isomorphous leaves, fibrillose throughout and with few, very tiny pores. Of them, *S. oxycladum* var. *mauritianum* appears to be most like *S. richardsianum,* as the leaves are of a similar size and show some development of pseudopores in short series. It seems, however, that the green cells of the branch leaves are much narrower in sectional view.

The species has been named as a token of friendly regard for Donald Richards, who has long been interested in the Mexican flora and has collected mosses there and elsewhere in Middle America. Duplicates of the specimens cited above are to be found in the herbarium of the University of Tennessee.

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CALCEOLARIA MEXICANA and *C. TRIPARTITA* IN MEXICO

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The large genus *Calceolaria* (Scrophulariaceae), variously estimated to comprise at least 200 and perhaps as many as 400 species, is mainly South American in distribution. It includes one well-marked group of about 20 species (Sect. *Aposecos* Benth., sensu Kränzlin, Fr., in Pflanzenreich IV. 257C [Heft 28]: 21–122. 1907; Subg. *Calceolaria,* sensu Edwin, G., in Fl. Peru, Field Mus. Publ. Bot. 13, pt. 5-B: 518, 552. 1971), in which the locules of the anther are not contiguous, but separated at the two ends of a long connective that may be longer than the locules themselves. All known material from Mexico and most of the specimens from Central America belong to this group, and have by most authors since 1839 been referred to *Calceolaria mexicana* Benth., the type of which came from the mountains of south-central Mexico.

One of us (Landrum) undertook to study what seemed to be unusually great variability in the leaf-form and plant-habit in the Mexican representatives of this group, anticipating the existence of regional populations within the species. He concluded after preliminary examination of a limited number of specimens that there were in fact two rather well-marked species involved, rather than the one traditionally recognized. We have subsequently examined a suite of more than 200 specimens from six herbaria (F, GH, MICH, MO, PH, US) and our studies indicate conclusively that the two species occur more or less co-extensively, both in Mexico and in Central America. In Mexico (excluding Chiapas) one is almost confined to the Sierra Volcánica Transversal; the other is found in the same region, but ranges farther northwest (into Durango and Sinaloa), and is known from a number of localities in the Sierra Madre del Sur in Guerrero and Oaxaca. Both are montane, but one is more restricted to the higher elevations at least in Mexico. Habitat-preferences of the two are similar. The two grow together or near together at some localities, e.g. near Comunidad, Edo. de México (*Hinton 4888, 4194*) near Antigua, Guatemala (*Molina 24809* includes both species, one at F, the other at MO); northwest of San Marcos, Guatemala (*Steyermark 35706, 35730*, with different habitat-data); along Río Chiriquí Viejo, above Guadalupe, Panama (*Croat & Porter 16024, 16038*). In Mexico we know of no localities where the two have been found intimately associated; in western Mexico (Durango, Jalisco, Michoacán), where rather numerous collections have been made from favorable localities, no more than one species has ever been collected in any one mountain range. In spite of the very considerable similarities between the two, they are readily separated by the characters used in the key below, and we do not hesitate to treat them as distinct. One of them is evidently *C. mexicana*; the other, after comparison with a number of South American specimens named by F. W. Pennell, and after study of the *Flora of Peru* (Edwin, 1971), we suppose to be *C. tripartita* Ruiz & Pavón. Others have suggested that *C. tripartita* may occur in Central America; Standley & Williams (Fieldiana Bot. 24, pt. 9: 341. 1973) considered the possibility that *C. mexicana* was a synonym of *C. tripartita.*

We are grateful to the curators of the herbaria listed above for loans of specimens and for other courtesies.

From the following description, which applies identically to the two taxa, it is not difficult to understand why they have been confused:

Annual herbs, the branches opposite, or dichotomous above; stems softly to firmly herbaceous, yellow-green to purplish; herbage bearing numerous multicellular, often glandular, hairs, the upper parts of the plant more densely pubescent; leaves opposite, green to yellow-green, petiolate, ovate to lanceolate in outline, membranaceous to slightly fleshy, the margins coarsely or finely serrate or doubly serrate; upper leaves passing gradually into the bracts of the inflorescence; inflorescence often much reduced, but when well-developed dichotomous, the two branches sometimes branching again dichotomously, often with 1 (–2) flowers in the crotch of each dichotomy, the individual branches terminating in small corymbs, racemes, or umbels; pedicels 0.5–3.5 cm long; pedicels and calyx glandular-pubescent; calyx 4-lobed, the lobes slightly unequal; corolla yellow, two-lipped, constricted between the lips, the lower lip saccate, inflated, the upper lip saccate, hoodlike; stamens 2, attached to the corolla at its base, one on each side of the ovary; filaments very short or almost wanting; anther-locules separated by an elongate connective; fertile locules splitting longitudinally, white when empty, yellow when pollen-filled; ovary glandular-pubescent; style slender, often persistent until the capsule matures and opens; capsule splitting longitudinally along 4 sutures; seeds numerous, ellipsoid, 0.5–1 mm long, black to brown with longitudinal ridges.

The principal differences between the two taxa are summarized in the following key, and set forth below in the appended descriptions. It may be noted that the differences in flower-color appear to be more evident after drying than in the fresh condition. We have not compared them directly, but collectors' notes made in the field often refer to the flowers of *C. tripartita* as light yellow, pale yellow, lemon yellow, or sulphur yellow, and only seldom as golden yellow or bright yellow. The flowers of *C. mexicana* are seldom described as pale yellow, but more often as bright yellow or sulphur yellow, and sometimes as deep or rich yellow. The differences in the dried corollas are usually striking when the two are compared.

1. Lower locule of the anther fertile, polleniferous; corolla pale yellow when dry, 0.5–1 (–1.5?) cm long, 0.3–0.6 cm wide when pressed; capsule subglobose, at maturity 3–5 mm long, usually not surpassing the calyx-lobes; cauline leaves toothed, pinnately incised, or lobed, if deeply pinnatifid the sinuses seldom approaching the rachis (midvein), and the upper leaves and bracts mostly finely or coarsely toothed or irregularly lobulate; stem usually collapsing when dried; plant mostly decumbent, extensively rooting at the nodes. *C. mexicana.*
1. Lower locule of the anther infertile; corolla dark yellow when dry, mostly 1–1.5 cm long, 0.8–1.2 cm wide when pressed; capsule ovoid, at maturity (5–) 6–8 mm long, surpassing the calyx-lobes; cauline leaves at least in well-developed plants pinnate, the blades dissected to the rachis or essentially so, only the smallest bracts of the inflorescence less deeply pinnate or pinnatifid; stem remaining round and firm, not collapsing, when dried; plant normally erect, from a short primary root. *C. tripartita.*

Calceolaria mexicana Benth. Pl. Hartw. 47. 1839. *Calceolaria tracheliifolia* Mart. & Gal. Bull. Acad. Brux. 12, pt. 2: 16 [repr. 2]. 1845. *Calceolaria urticina* Kränzlin, Repert. Sp. Nov. 1: 82. 1905.

Moist rocks along streams, shaded ravines and banks, in barranca-forests with deciduous trees, or with firs or in humid pine-oak forest, mostly 2000–3000 m, flowering Jul–Apr in Mexico, or throughout the year.

Sinaloa, western Durango, Jalisco, Michoacán (Angangueo, *Hartweg 356,* the type), Guerrero, México, Morelos, Veracruz (Peak of Orizaba, *Galeotti 1056,* type of *C. tracheliifolia*), Hidalgo, Puebla, Oaxaca, Chiapas; through Central America to Panama. The type of *C. urticina* (*Uhde 1203*) came from some unknown locality in Mexico. We have seen photographs of the type of *C. mexicana* (MICH Neg. 817) and *C. urticina* (Field Mus. Neg. 14142), and of an isotype of *C. tracheliifolia* (from W, Field Mus. Neg. 32918).

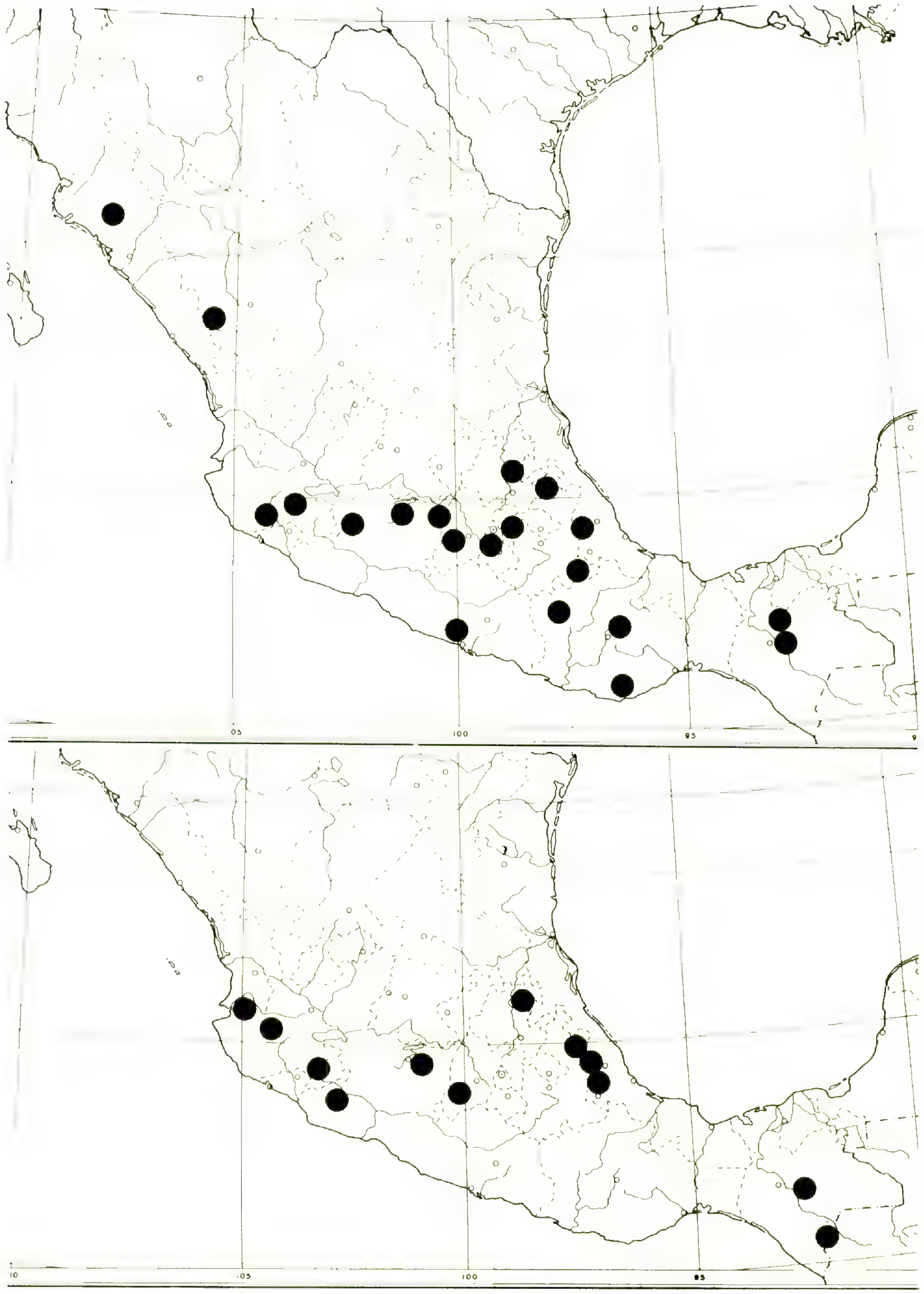

FIG. 1. Distribution in Mexico of *Calceolaria mexicana* (above) and *Calceolaria tripartita* (below). Localities are those of specimens cited in the text.

Plants mostly 20–40 cm tall, usually partially decumbent, arising from a stiff, gradually tapered primary root; fibrous roots arising from the primary root and usually from one or more nodes, these nodes with or without leaves; leaves often purplish beneath, the blades (1–) 3–10 (–12) cm long, (1–) 2–6 (–13) cm wide, pinnately lobed or unlobed; upper leaves and bracts gradually becoming smaller, proportionately narrower and less dissected toward the top of the plant; calyx-lobes ovate to lanceolate, acute, 2–5 mm long, 1.5–2 mm wide, each with ca 7–10 more or less distinct parallel veins; narrowest part of the isthmus between the corolla lips ca 1/2–2/3 the width of the wider lip; corolla 5–10 (–14) mm long, 3–6 mm wide when pressed, the lower lip elongate, the upper only 1–3 mm long; anther-connective ca 1 mm long, the proximal arm (that directed toward the upper lip) thicker than the distal; locules usually shorter than the connective; ovary globose, the style ca 1 mm long.

In the citations that follow, we have included most of the material from Mexico. Existing collections are fewer, and it is possible to document to a considerable extent the geographical separation of the two taxa as far as indicated by the specimens in hand. The number of existing specimens from Central America, particularly from Guatemala and Costa Rica, is very much greater, and our personal knowledge of the area is correspondingly less, so we have cited no more than a sample indicating the longitudinal range of each taxon as it is known to us. We have not attempted to follow either species beyond Central America.

Representative specimens examined: MEXICO: SINALOA: Sierra Surutato, *Breedlove 16923, 17102, 18258, 18380* (all MICH). DURANGO: ca 29 km W of La Ciudad, *Cruden 1169* (GH, MICH); between Villa Unión and El Salto, *Ownbey & Ownbey 1934* (GH, MICH, US). JALISCO: La Estancia, camino a Tapalpa, *Villarreal 5398* (MICH); Sierra de Manantlán, SE of Autlán above El Chante, *Wilbur 1794, 1930; McVaugh 10305* (all MICH). MICHOACAN: Tancítaro, 9000 ft, *Leavenworth 724* (F, GH); near Morelia, Cerro Azul, *Arsène 6735* (MO, US); Zitácuaro to Cerro Pelón, *Hinton 13231* (F, GH, MICH, US). MEXICO: Dist. Temascaltepec, Comunidad, *Hinton 4194* (GH, MICH, US); ca 35 km N of Temascaltepec, *Anderson & Anderson 5026* (MICH); Nevado de Toluca, *Rose & Painter 7896* (PH); Mpio. de Texcoco, SE of San Pablo Ixayoc, *Rzedowski 24183* (MICH); Río Frío, *Sharp 44151* (GH, PH). MORELOS: Lakes of Zempoala, *Langman 2662* (PH). GUERRERO: Dist. Mina, Campo Morado, *Hinton 11172* (F, GH, MICH, US); Mpio. de Tlacotepec, Cerro Teotepec, *Hinton 14797* (F, GH, US), *Rzedowski 18143* (MICH), *Feddema 2909A* (MICH); ca 14 km SSW of Campamento El Gallo, 17°25′ N., 100°14′ W., *Rzedowski & McVaugh 23* (MICH). HIDALGO: Trinidad, *Pringle 13488* (US); road to Metztitlán, between Zacualtipán and Olotla, *Moore 2394* (GH). VERACRUZ: Orizaba, *Liebmann 9481* (GH), *Botteri 508* (US); Mt. Orizaba, *Seaton 220* (F, GH, US). OAXACA: Between Cerro Machín and Llano de las Flores, *Beaman 3684* (GH, US); Cerro [Sierra] San Felipe, *Nelson 1081* (GH, US), *Andrieux 177* (GH), *Camp 2368* (MICH), *Pringle 4712* (GH, MO, PH, US); Cerro Zempoaltepetl, *Hallberg 927* (MICH); Sierra Madre del Sur, S of S. Miguel Suchixtepec, *Anderson & Anderson 4799* (MICH); ca 50 km ["30 mi"] N of Puerto Escondido, *Lasseigne 4957* (MICH). PUEBLA: Cerro de Gavilán, *Purpus 3949* (F, GH, MO, US); 8 km N of Huauchinango, *Moreno G. 74* (MICH). CHIAPAS: Mpio. de Tenejapa, *Breedlove 9287* (F); Mpio. Pueblo Nuevo Solistahuacán, *Breedlove 9001* (F, MICH, US), *Clarke 276* (MICH), *Ton 3981* (MICH).

CENTRAL AMERICA: GUATEMALA: Chimaltenango: Cerro Chichoy, *Williams & Molina 15346* (F, GH). Chiquimula: Cerro Brujo, near Brujo, *Steyermark 30942* (F, PH). Guatemala: 7 km SE of Guatemala City, *Harmon 2251* (MO). Huehuetenango: ca 10 km SW of Huehuetenango, *Williams et al. 22612* (F). Quezaltenango: Finca Pirineos, entre Santa María de Jesús y Calahuaché, *Steyermark 35192* (F, PH); Volcán Zunil, *Steyermark 34922* (PH). Retalhuleu: Finca Helvetia, *Muenscher 12427* (GH). San Marcos: W of Ixchiguan, ca 3500 m, *Beaman 3250* (GH); Tajumulco, *Steyermark 36904* (PH); ca 10 km W of San Marcos, *Williams et al. 27184* (F, US). Sololá: Above Lake Atitlán, W of Panajachel, *Williams et al. 25379* (F, US). Totonicapán: Near Momostenango, *Molina 21425* (F, GH).

EL SALVADOR: Chalatenango: Los Esesmiles, *Tucker 1020* (F, MICH, PH, US).

COSTA RICA: Cartago: NW of Volcán Irazú, *Stork 2006* (MICH); foot of Orosi waterfall, *Rodríguez C. 429* (GH, MICH); Cerro de la Muerte, 3600 m, *Allen 5679* (F, US), *Mori & Anderson 124* (F); Volcán Turrialba, *Greenman & Greenman 5594* (MO). Heredia: Between Poás and Barba volcanoes, *Skutch 3533* (MO). San José: Ca 10 miles SE of La Asunción, *Wilbur & Almeda 16969* (MO); S of Cartago, *Stork 4505* (MICH); 20 km N of San Isidro del General, *Williams et al. 28512* (GH, US); Las Nubes, *Hunnewell 16738* (GH); páramo of Cerro Buena Vista, 3450 m, *Rodríguez C. 442* (MICH).

PANAMA: Chiriquí: between Cerro Punta and Quebrado Bajo Grande, *Wilbur et al. 11886* (GH, MICH); along Río Chiriquí Viejo above Guadalupe, *Croat & Porter 16038* (MO); La Popa above Boquete, *D'Arcy & D'Arcy 6421* (MO); Bajo Chorro, Boquete, *Davidson 139* (F, GH).

Calceolaria tripartita Ruiz & Pavón. Fl. Peruv. 1: 14. *pl. 20a.* 1798.

Moist rocks, springy banks, shaded ravines and hillsides, in barranca-forests with deciduous trees, or with firs or in humid pine- or pine-oak forest, 550–2400 m over most of its range in Mexico, ascending to 2800–3000 m or more in Central America, flowering Jul–Apr in Mexico, or throughout the year.

Jalisco, Michoacán, México, Hidalgo, Puebla, Veracruz, Chiapas; Guatemala, Costa Rica, Panama; apparently the same species in Jamaica; South America.

Our description of this taxon is based primarily on Mexican and Central American material:

Plants 25–150 cm tall, erect (at least in Mexican and Central American populations), arising from a more or less horizontal primary root, this usually strongly tapered, with slender stiff secondary roots; leaf-blades (1–) 3–12 cm long, (1–) 3–10 cm wide, pinnately lobed, the most deeply dissected leaves appearing compound; margins sometimes obscurely toothed or subentire; upper leaves and bracts gradually becoming smaller and proportionately narrower above, the lobes becoming smaller and narrower, eventually intergrading with the teeth of the margin; petioles often connate; calyx-lobes ovate, acute to acuminate, 4–6 mm long, 3–4 mm wide, each with ca 9–12 more or less distinct parallel veins; narrowest part of the isthmus between the corolla-lips less than half the width of the wider lip; corolla 10–15 mm long, 8–12 mm wide when pressed, the lower lip broad, more or less round in outline when pressed, the upper lip only 2–3 mm long; distal anther-locule (that directed toward the lower carolla-lip) infertile and atrophied, the distal arm of the connective 1 mm long; proximal arm very short, the locule fertile, ca 1 mm long; ovary slightly elongated, the style ca 2 mm long; tips of the capsule valves commonly recurved after opening.

Representative material examined: MEXICO: JALISCO: San Sebastián, *Mexia 1366* (F, GH, MICH, MO); Mpio. de Talpa, *McVaugh 21527* (MICH), *González T. 401* (MICH); 40 km W of Ayutla, NW of San Miguel de la Sierra, *McVaugh 22039* (MICH); Mpio. de Tecalitlán, Sierra del Halo, *McVaugh & Koelz 1124* (MICH); Guadalajara, *Palmer 624* in 1886 (GH). MICHOACAN: W of Aguililla, region of Aserradero Dos Aguas, *McVaugh 22802, 24771* (both MICH); 19 miles E of Morelia, *Weber & Charette 11868* (MICH). MEXICO: Rincón, Temascaltepec, *Hinton 324* (GH, US); Comunidad, Temascaltepec, *Hinton 4888* (GH, US). HIDALGO: Near Molango, *Moore 2420* (GH). PUEBLA: Teziutlán, *Barnes & Land 548* (F), *Orcutt 4041* (F, GH, MO), *Seler 3629* (GH). VERACRUZ: Sta. Ana Atzacán N of Orizaba, *Rosas R. 284* (GH); Zacuapán, barranca de Tenampa, *Purpus 3664* (F, GH, MO, US); Mpio. de Atzalán, Tomata, *Ventura A. 593* (MICH); Teocelo, 1000 m, *Ventura A. 9474* (MICH). CHIAPAS: Siltepec, *Matuda 865* (F, MICH, MO); Finca Irlanda, *Purpus 7169* (F, GH, US); Mt. Ovando, *Matuda 2192* (MICH); Mpio. S. Cristóbal de las Casas, Zontehuitz near the summit, *Breedlove 7806, 12354* (both MICH); Mpio. Zinacantán, Paraje Sequentic, 1350 m, *Breedlove 28705* (MICH).

CENTRAL AMERICA: GUATEMALA: Alta Verapaz: Cobán, *v. Tuerckheim II 636* (F); near San Cristóbal Verapaz, *Williams et al. 42213* (F); San Pedro Carcha, *Williams et al. 40500* (F, MO, US). Chimaltenango: Above Las Calderas, *Standley 60006* (F); near Los Idolos bridge ca 5 km W of Patzún, *Williams et al. 41586* (F). Jalapa: 6 mi S of Miramundo, *Steyermark 32669* (F). San Marcos: Near Aldea Fraternidad, between San Rafael Pie de la Cuesta and Palo Gordo, *Williams et al. 25962* (F, US). Quezaltenango: Along Río Samalá, near Santa María de Jesús, *Standley 84686* (F). Quiché: W of Chichicastenango, *Molina et al. 16315* (F, GH).

COSTA RICA: Alajuela: Near La Laguna, 6–8 km S of Villa Quesada, *Williams et al. 17500* (F, GH, US); ca 4 mi N of Varablanca, *Wilbur & Teeri 13822* (MICH). Cartago: Near La Sierra ca 25 km S of Cartago, *Williams et al. 28170* (F, GH, US). Heredia: Vara Blanca de Sarapiquí, between Poás and Barba volcanoes, *Skutch 3548* (MO, US). San José: 7.4 km by winding road west of Sta. María de Dota, *Wilbur & Stone 10515* (F, MICH, MO).

PANAMA: Chiriquí: Ca 4 mi NW of Boquete, *Wilbur et al. 13497* (MICH, MO); Río Caldera beyond Bajo Mono, near Boquete, *Wilbur et al. 11049* (MICH, MO).

We have no evidence that *C. mexicana* and *C. tripartita* hybridize, but we do not reject this possibility. When the two species are recognized in the field, growing near together or at the same locality, it would be useful to search for hybrids.

Contr. Univ. Mich. Herb. 11(5):289–290. 1978.

A NEW *ASCLEPIAS* FROM ZACATECAS, MEXICO

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What seems to be a very distinctive but as yet undescribed species of *Asclepias* was discovered in July 1975 by Mr. Salvador Correa of Western Michigan University, near the dry forested summits of the great ridge between the Río Juchipila and the Río Bolaños, in southern Zacatecas. Unfortunately Mr. Correa's specimen was without fruit, but the flowers are so remarkable there seems to be no doubt the plant is unique.

Asclepias zacatecana McVaugh, sp. nov. Fig. 1.

Herba puberula debilis 30 cm alta ut videtur perennis, foliis linearibus oppositis 6–12 cm longis, 3–5 mm latis, attenuatis, umbellis axillaribus paucifloris quam foliis triplo brevioribus; flores 3–7, pedicellis tenuibus 1–2 cm longis instructi, atropurpurei sed cucullis apicem versus pallidis subhyalinis; calycis laciniae ellipticae 2–2.5 mm longae; corolla 7–8 mm longa, sub anthesi rotato-reflexa, lobis ovatis acutis; gynostegium stipitatum, columna late cylindrica 1–1.3 mm longa, 1.5 mm lata, cucullis erectis 5–6 mm longis, delicatulis, lateraliter compressis sessilibus base saccatis, eis marginibus valde in dentibus erectis prolongatis, cornu valde adnato dentato cucullo longiore; androecium conicum, ca. 1.5 mm longum latumque; folliculi mihi ignoti.

Leaves essentially glabrous, attenuate at both ends, 1-nerved; umbels in the upper axils, the peduncles puberulent, 2–3 cm long; pedicels puberulent adaxially; calyx, corolla, and the bases of the hoods apparently dark purple, the distal parts of the hoods including the horns nearly white or colorless, very thin and delicate; hoods apparently fleshy and firm at base, rounded on the backs, open adaxially, somewhat contracted on the sides above the basal attachment, truncate at apex but obscurely toothed abaxially between the two prolonged marginal teeth; horn usually with two short abaxially directed teeth above middle; anther-head with conspicuous hyaline apical appendages, and with the wings dilated toward base and bearing each an apical notch.

ZACATECAS: Near summits between Jalpa and Tlaltenango, steep mountainsides in deep soil, oak forest with *Pinus lumholtzii, Arbutus* spp., *Prunus serotina,* elev. ca 2400–2500 m, 22 July 1975, *Correa 25* (MICH, type). Known only from this collection.

In Nueva Galicia there are several species of *Asclepias* that are herbs with opposite and essentially linear leaves. None of these shares with *A. zacatecana* the characters of dark, rotate-reflexed corolla, short but definite column, and long and characteristically toothed hoods. Superficially somewhat similar is *A. gentryi* Standl., in which the flowers are red and yellow, the hoods only 3–4 mm long and obtuse, and the translator-arms broadly triangular, larger than the gland.

It is noteworthy that in at least one flower of the type of *A. zacatecana,* the number of pollinium sacs was usually 3 in each unit. The central one was located in the flower between the wings of adjacent anthers; it seemed normal but slightly smaller than the two lateral ones.

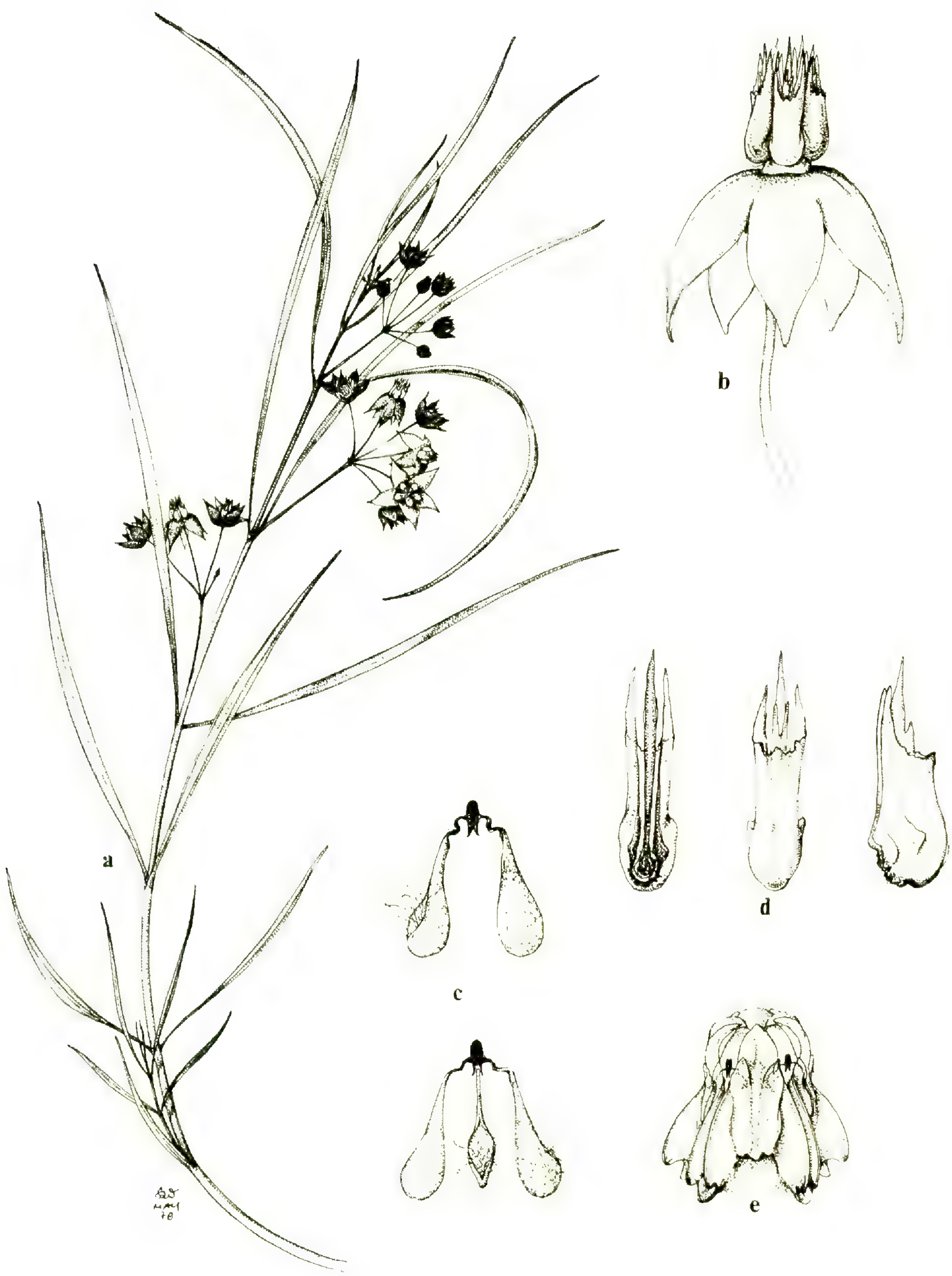

FIG. 1. *Asclepias zacatecana,* drawn from the type by Karin Douthit. a, flowering branch × 0.5; b, flower × 2.5; c, germinating pollinia × 15; d, adaxial, abaxial, and lateral views of hood × 5; e, anther-head × 10.

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GALEOTTI'S BOTANICAL WORK IN MEXICO: THE NUMBERING OF HIS COLLECTIONS AND A BRIEF ITINERARY

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Henri-Guillaume Galeotti (1814–1858) travelled in Mexico from December, 1835, until June, 1840. Almost all that is definitely known about his travels is recorded by Lasègue (Mus. Bot. Benj. Delessert 209–211. 1845), apparently on the basis of information provided by Galeotti himself. The several memorial and obituary accounts published after Galeotti's death do essentially nothing but repeat statements made by Lasègue. Galeotti collected a large number of herbarium specimens including many duplicates which have been distributed to more than 20 herbaria (cf. Regnum Veg. 9: 214. 1957). The "original" set (but by no means a complete set) is assumed to be at BR. According to a report prepared by Cogniaux in 1875 for the Museum in Brussels, the set at BR consists of about 4620 numbers out of a total of 7297. The report concludes rather plaintively that the most complete sets outside of Brussels are at Kew, at Paris, and at Vienna.

As soon as Galeotti returned to Europe, in the latter part of the year 1840, he began in collaboration with Prof. Martin Martens of the University of Louvain a systematic enumeration of the plant-collections made in Mexico. The first part completed seems to have been that on the ferns and fern allies, presented to the Royal Academy of Belgium at the meeting of 15 January 1842 (Martens & Galeotti, 1842). The remainder of the enumeration, dealing with the representatives of about 60 families of flowering plants, appeared in 19 parts between 1842 and 1845 in the *Bulletin* of the Académie Royale (Martens & Galeotti, 1842–1845).

In the memoir on the ferns, and in the *Enumeratio systematica,* it was the authors' practice to cite one or more of Galeotti's collections by number under each species, and to cite at the same time one or more localities, thus:

> **2. Wigandia crispa. HBK.**
>
> (Col. H. Gal. No. 1436.)
>
> Sur les rochers d'Acultzingo, près Tehuacan, à 6,500 pieds; près d'Oaxaca et de Mitla et dans la Sierra de Yavesia, de 5,000 à 6,500 pieds.

When more than one locality is mentioned in the printed text, or more than one number is cited, it may not be possible to determine the source of any particular specimen, particularly since many of the duplicates are not very fully labelled.

The present note is written to correct what seems to be a fairly widely held misconception, namely that the numbers assigned to Galeotti's collections in the *Mémoire sur les fougères* and in the *Enumeratio* are consecutive field-numbers assigned by the collector at the time of collection. I have never seen any evidence that this might be true. A brief inspection of the published texts will show that the numbers must have been assigned in Europe, after the collections had been sorted and at least tentatively arranged by plant-families. The different sets of the same gatherings, even

those presumed to belong to the original set at Brussels, all appear to bear the numbers cited in the *Mémoire* or in the *Enumeratio.*

The numbers cited in publication run from 1 to 7237, as far as I have been able to ascertain (presumably there were originally 7297 numbers, judging from the note by Cogniaux mentioned above). Apparently the numbers were assigned after preliminary inspection and tentative assignment to family groups. For example the groups called *Spigeliae* and *Gentianae* were separated in publication, but evidently were not distinguished in the preliminary sorting, as the specimens belonging to the two groups are assigned the numbers 1471–1483, in no particular order. Some Rubiaceae bear numbers between 1572 and 1592, apparently having first been included among the Apocynaceae, to which the inclusive numbers 1557–1594 were given.

By far the majority of Galeotti's collections, after sorting according to a predetermined system, were gathered into one principal series and assigned numbers from 1 to about 6614, beginning with the Gymnosperms and Amentiferae, continuing through the dicots to Leguminosae, then through the monocots from Alismataceae to Araceae (with Piperaceae thrown in just before Araceae), and ending with the Pteridophyta. There are many gaps in the series, and some large families, including the Compositae, are not treated. The orchids were summarily treated by A. Richard and Galeotti (Monographie des Orchidées Mexicaines, etc., in Comptes Rend. Acad. Sci. [Paris] 18: 497–513. 1844).

In addition to the principal series of numbers, there is a second series running from about 7016 to 7237. This includes about 53 separate collections from about 60 cited localities. With one exception (no. 7111, a species of *Piper*), all the collections numbered 7000 or over belong to one of the following families: Convolvulaceae, Boraginaceae, Scrophulariaceae, Verbenaceae, Polemoniaceae, Rubiaceae, Valerianaceae, Caprifoliaceae, Hydrophyllaceae, Gentianaceae, or Asclepiadaceae, and all except one or two are from Veracruz or Oaxaca. How these came to be passed over in the primary enumeration I cannot say; perhaps they were first put aside as a mixed lot of "gamopetalae" and then later numbered without any attempt to order them geographically or systematically.

In the 19th Century arbitrary numbering of large collections in some systematic order was a common practice. Preliminary sorting of the specimens brought together all those thought to represent the same genus or species, and the original field-data were often partly or wholly discarded or combined, at the same time all material of one supposed species was assigned a single number. I have commented previously on Hartweg's collections on which George Bentham reported in full between 1839 and 1857, and Edward Palmer's collections of 1878–1880 that were sorted and numbered by C. C. Parry and Sereno Watson (Introduction to Plantae Hartwegianae, pp. 20–21. Lehre, 1970; Edward Palmer, pp. 76–82. 1956).

In a recent article on *Galium aschenbornii* in Mexico and Central America (Brittonia 25: 17. 1973), the name *Rubia acuminata* Mart. & Gal. was lectotypified by a specimen (no. 2362) from Hooker's herbarium at Kew (K). This was done in spite of the fact that the numbers cited by Martens & Galeotti (Bull. Acad. Brux. 11, pt. 1: 127. 1844) were 2631 and 2632, and the additional fact that Galeotti's types are usually assumed to be at Brussels (BR), not at Kew (K). In a later number of the same journal (Brittonia 25: 313. 1973), the same author emphasized, after examination of the specimens both at K and at BR, that both in fact bore the number 2362 (not 2632 as cited in the protologue of *Rubia acuminata*). In this latter note it was also suggested that the specimen at BR, not that at K, should correctly be taken as the holotype.

The remarks that led me to publish the present note are in the earlier paper in *Brittonia,* cited above:

"There is a specimen at Kew that almost certainly is the one to which Martens & Galeotti referred, but it bears the number *2362* instead of *2632.* If we are right in assuming it to be of the collection referred to by Martens and Galeotti, then either the label on the specimen is incorrectly numbered, or the number in the original publication is wrong. The latter interpretation is probably correct, in view of the fact that *2631* was collected at 9000 ft, and *2632* (or *2362*) at 5000 ft. It is difficult to suppose that Martens & Galeotti went down 4000 feet between two consecutive collections. It is much easier to believe that they went up 4000 feet while collecting the 269 numbers between *2362* and *2631."*

Unfortunately there is no justification for the assumption that consecutive numbers are necessarily related to one another. Galeotti's nos. 2631 and 2632 are adjacent because they were presumed to represent the same species, not because of any geographical or temporal connection between them. The numbers assigned to the Rubiaceae included one principal series from about 2556 to 2659, a smaller series (not continuous) from 1572–1592, and no. 1756. In the above instance it may be supposed that the number 2362 on the specimens at Kew and Brussels resulted from a clerical error that was copied when Galeotti's duplicate specimens were distributed. It is possible, or even likely, that the specimens bearing this number are isotype and holotype, respectively, but if so there is little doubt that they have been erroneously labelled, and that the correct number should be *2632.*

Part 2. Galeotti's travels in Mexico, 1835–1840

The skeleton of the following account is provided by the data published by Lasègue (1845), although as explained below there are some apparent inconsistencies in Lasègue's statements. The skeleton has been fleshed out a little by references from the series of papers, mostly geological in nature, that Galeotti published in the *Bulletin* of the Royal Academy of Brussels between 1836 and 1841. Some additional information, relevant to dates and localities of collection, has been gleaned from the pages of the *Synopsis filicum* and the *Enumeratio systematica,* where months of collection (or flowering period) are customarily cited. For example, approximately 175 species are cited as from Real del Monte and nearby localities in Hidalgo. The dates, whether in fact those of collecting or those during which the plants were observed, or presumed, to flower, are almost all from the months of August, September, and October, suggesting that Galeotti spent a significant amount of time near Real del Monte during those months. This is seemingly confirmed by Lasègue, who says Galeotti spent "two or three months" there.

In the summary below, the data from Lasègue are so labelled. Data from the systematic enumerations by Martens and Galeotti are labelled "Mart. & Gal.," and references to Galeotti's geological papers are by date alone. No attempt has been made to include mention of all the localities visited by Galeotti, or even those cited in the *Synopsis* and the *Enumeratio.* My intention here is merely to establish as many firm dates and places as possible in an itinerary that can eventually be filled out in greater detail, especially if additional documentary evidence can be found in Belgium or elsewhere.

Sep 1835. Galeotti left Hamburg for Mexico (Lasègue).

Dec 1835. Arrived in Veracruz (Laségue). Fixed dates for specific localities visited by Galeotti before February 1837 are not available. He is known to have crossed to the Pacific side of Mexico on two or perhaps three different trips. One of these (that in 1837) is adequately documented, but our knowledge of the others comes indirectly, mostly from Lasègue. The latter states that the first trip to the Pacific Coast was made "a la fin de 1835," thus evidently almost immediately after Galeotti's arrival in Mexico. On this trip he is said to have travelled by way of San Juan del Río, Zelaya,

Salamanca, León, and Guadalajara, to San Blas, then to have returned to México (Lasègue).

Scheidweiler (1838, 1839) described more than 30 species of cacti collected by Galeotti, mostly "in provinciis Potosi et Guanaxuato." Most of the taxa seem from the descriptions to have been based on sterile specimens; this would have been natural enough if Galeotti had collected living plants (they were mostly Mammillarias) during the relatively dry and cold winter season and forwarded them to Europe. I find no record of any additional botanical collections made by him in this part of Mexico, but according to Lasègue he visited San Luis Potosí two years later, in December 1837 (see below).

Galeotti (1838a) published an account of the geology of Guanajuato; some of the data on which this was based may have been gathered in 1835–36, or during a later trip. The latter seems somewhat more probable, because it does not seem likely that he spent much time in Guanajuato, if indeed he visited that city on this earliest trip. Lasègue says specifically that after arriving at Veracruz in December, Galeotti went "ensuite" to Xalapa, where he spent 6 months before going on to Real del Monte in July, 1836.

Jan–June 1836. Xalapa, Veracruz (Lasègue; see above). About 125 collections cited in publication (Mart. & Gal.) are from Xalapa and about 32 from nearby points, mostly Apr–June, a few Jul–Aug; Galeotti's paper on the ascent of the Cofre de Perote (1836) was received for publication before 15 Dec 1836.

Jul 1836. Galeotti went to Real del Monte, Hidalgo (Lasègue) and stayed "two or three months" (see above). Presumably it was at this time that he gathered data for his papers on the geology of San José del Oro and the Barranca de Tolíman (1838b, 1838c).

Dec [?1836]. Trip to the Pacific Coast. It is possible but not established that Galeotti visited the coast in 1835–36, again in 1836–37, and a third time in 1837–38. A number of collections are cited (Mart. & Gal.) from Guadalajara, Chapala, Ixtlán, Tepic, and San Blas; all are dated December, January, or February. Galeotti seems certainly to have been in this part of Mexico in February, 1837 (see below) and again from late November onward in the following year, and if Lasègue's account is correct, his first trip must have been at the end of 1835.

Lasègue says (p. 210) that on his return from the coast in 1837 (i.e. between March and May) Galeotti visited Guanajuato and the Sierra de Santa Rosa; this was presumably on his route to México from Guadalajara. It may have been after his visits to the mining areas in Guanajuato that his paper of the geology (1838a) was written. The cacti collected in Guanajuato (cf. Scheidweiler, 1838, 1839) could have been collected partly in the spring of 1837.

27–28 Feb 1837. Lake Chapala, Jalisco. These dates are mentioned in Galeotti's paper on the geology of Lake Chapala (1839), which was signed at Mexico City 1 Jun 1837 and mailed to Brussels on 22 Aug 1837. Plant collections (Mart. & Gal.) from Guadalajara, Chapala, San Blas and intervening points, are mentioned above; the year of collection is always uncertain.

Spring 1837. Guanajuato and the Sierra de Santa Rosa; see above.

1 Jun 1837. México. Galeotti signed and dated a manuscript here (see above).

Jun 1837. Popocatépetl (Lasègue). Galeotti described his visit to Popo in July 1838 (q.v. below), but this may have been a second ascent. A few collections made in June (i.e. perhaps in 1837) are cited (Mart. & Gal.) from Peñón Viejo, Ayotla, and Ameca ("pied nord du Popocatepetl").

Jul 1837. Left México for Michoacán (Lasègue).

9 Aug 1837. Morelia, Michoacán (Galeotti, 1841).

22 Aug 1837. Morelia (Galeotti, 1838). On this day Galeotti was planning to leave the day after tomorrow for Jorullo. About 65 plant-collections, almost all made

in Aug, a few Jun–Sep, are cited (Mart. & Gal.) from the vicinity of Morelia, and 11 from the route between México and Morelia.

1 Sep, 4 Sep 1837. Ario, Michoacán (Galeotti, 1841). Judging from the citations of specimens (Mart. & Gal.), Galeotti went from Morelia to Pátzcuaro, Ario, and Jorullo, returned to Ario, Taretán and Uruapan, thence past the foot of Tancítaro to Los Reyes and on to Guadalajara.

3 Oct 1837. (Galeotti, 1841). "je me dirigeais sur Guadalajara."

22 Nov 1837. (Galeotti, 1841).Guadalajara. About 35 collections are cited (Mart. & Gal.) from Guadalajara and vicinity, Dec–Feb. The year of collection is uncertain; see above.

Dec 1837. Trip to Aguascalientes and San Luis Potosi (Lasègue). The implication is that Galeotti left from México and returned to that city on the conclusion of the excursion: "Il se dirige vers le nord sur Aguas-Calientes et sur San-Luis-Potosí, ... De retour à Mexico, en avril 1838, après un voyage de 4 à 500 lieues. . . ." Many of the cacti described by Scheidweiler (1838, 1839) may have been collected during this period.

If Galeotti was indeed in Guadalajara during the last week of November, 1837, after traveling for some 4 months in Michoacán and Jalisco, it is not clear why he should have returned to México and then immediately set out for another long trip (this one for another four months) to the north. It seems that it would have been more convenient for Galeotti to include Aguascalientes and San Luis Potosí on his itinerary from Guadalajara to México before his return to the capital in April.

Feb. [?1838]. Collections made in February are cited (Mart. & Gal.) from San Blas, Nayarit, and from between San Blas and Guadalajara; see above under Dec [?1836]. Galeotti seems to have been working on the geology of the region around Lake Chapala in February 1837; whether or not he also made the trip from there to the Pacific Coast is unknown. Since he was still in Guadalajara in November 1837, it is conceivable that he stayed in this part of Mexico for some weeks longer.

Apr 1838. Return to México (Lasègue).

?May 1838. Establishment of headquarters at Mirador and Zacuapán, Veracruz (Lasègue). By far the greatest numbers of collections cited (Mart. & Gal.) are from Mirador (ca 200) and Zacuapán (ca 175). Of those cited, about 120 are dated Jun–Oct, and about 50 Nov–May.

Jul 1838. Popocatépetl. (Galeotti, Bull. Acad. Brux. 10, pt. 2: 36. 1843). In writing of *Lupinus mexicanus,* Galeotti describes the snow on Popocatépetl, and says in a footnote, "Extrait de notes recueillies pendant notre ascension sur le volcan de Popocatepetl, en juillet 1838."

Aug 1838. Visit of 11 days to Citlaltépetl (Pic d'Orizaba) (Lasègue). Galeotti refers several times to the date of this ascent as Aug 1838. He went up from San Juan Coscomatepec, then via Totozinapa to the Vaquería del Jacal, thence 3000 feet higher to the Cueva del Temascal. About 120 collections from these localities, mostly dated Aug, are cited (Mart. & Gal.). Lasègue says the ascent of Orizaba was made with three friends and botanical companions, MM. Funck, Ghiesbreght, and Linden.

Sep 1838–Mar 1839. Galeotti apparently maintained his headquarters at Mirador and Zacuapán. He implies (1841) that he saw shooting stars at Zacuapan on 7 Dec 1838 and for several days before that.

Apr 1839. Left Mirador, via Córdoba, Orizaba, and Acultzingo, for Tehuacán and Oaxaca (Lasègue). Lasègue's account of Galeotti's subsequent travels in Oaxaca is very brief. He mentions visits to Cerro San Felipe, and to Yavezía, Castresana, etc., in the "eastern" Cordillera and in the Chinantla. He also mentions a trip to the Pacific Coast south of Oaxaca, with visits to Sola, Juquila, and a return to Oaxaca [City], at the end of 1839, followed by some excursions near Oaxaca, the return to Mirador, and Galeotti's final departure from Mexico in June 1840. Because of Lasègue's brevity, it

has been necessary to reconstruct the following account from the citations of localities and dates in the *Enumeratio Systematica* (Mart. & Gal.), and from a few firm dates mentioned by Galeotti in his paper on earthquakes (1841).

Apr 1839. Galeotti evidently spent some time in the Mixteca Alta, a mountainous area west and northwest of Oaxaca, in the month of April. Lasègue says this was after his return from the south coast, and if so it must have been in April, 1840. It is also possible that he visited such places as Peñoles, Jaltepec, and Nuxine, all mentioned by Lasègue, in April 1839.

May 1839. Galeotti apparently visited Cerro San Felipe north of Oaxaca, and Capulalpan, a day's journey to the northeast of Oaxaca. It seems unlikely that he returned to Oaxaca over the mountains before going on into the remote mountains of the Chinantla.

Jun 1839. Trip to the Chinantla (including such localities as Villa Alta, Roayaga, Tonaguía, Choapam, Teotalcingo, La Lana, Jocotepec, Tepinapa), perhaps after a series of shorter collecting trips in the mining regions around Yavesía and Capulalpan. He was in Choapam on 16 Jun 1839 (Galeotti, 1841).

Jul 1839. Return to Oaxaca, perhaps early in the month. He mentions shooting stars in Oaxaca on 10 July, and an earth tremor on 13 July (Galeotti, 1841).

Aug 1839. Galeotti apparently worked out of the city of Oaxaca, or made several extended excursions from there. About 40 species are cited (Mart. & Gal.) as from Tehuacán, Puebla, and from localities (Río de las Vueltas, Don Dominguilla, Cuicatlán) between Tehuacán and Oaxaca, all with date of August. Numerous collections with date of August or September suggest that Galeotti again visited the mining regions to the northeast of Oaxaca (Cerro de San Felipe, Sierra de Capulalpan, Hda. del Carmen, Llano Verde, Yavesía). During this summer Galeotti must have passed some days at the mining centers of Castresana (Hda. del Carmen) and Yavesía; in his paper on extracting silver (1842) he acknowledges assistance received from M. Fenochio, Director of the English Company at Yavesía, and from M. Jurgensen at Castresana. Hemsley (Biol. Centr. Amer. Bot. 4: 126. 1887) says that Jurgensen collected for Galeotti after the latter's return to Europe. Collections by Jurgensen (or Jürgensen), from various parts of Oaxaca, have in any event been widely distributed.

Sep 1839. Trip to the Pacific Coast; as determined from citations (Mart. & Gal.) the route took Galeotti by way of Sola de Vega, Juchatengo, Juquila and thence southwestward to the settlement of Río Grande near the ocean.

Nov 1839. On the return trip, he stopped in Sola de Vega "vers les premiers jours de novembre" (Galeotti, 1841). To judge from citations in the *Enumeratio,* Galeotti may have reached Juquila (16°14′ N., 97°17′ W.) about the end of September and spent some days there and on the trails between there and the coast, before beginning the return to Oaxaca.

Late Nov 1839–Feb 1840. Citations suggest that Galeotti again visited the mining regions to the northeast, perhaps as far as Yavesía, Capulalpan, and Llano Verde, and collected in the Mixteca Alta in February.

Mar 1840. Few species with date of March are from localities in Oaxaca, so it appears that Galeotti must have returned about this time to Mirador, presumably by way of Tehuacán as he had come (Lasègue).

Jun 1840. Left Mexico (Lasègue). Galeotti (1841) mentions an incident that occurred on shipboard in July 1840, "quelques jours après mon depart de La Havane."

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A NEW SPECIES OF *PEDICULARIS* FROM JALISCO, MEXICO

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In 1975 a paper on the Mexican species of *Pedicularis* (Scrophulariaceae) with "pinnately parted or dissected leaves" appeared in these Contributions (McVaugh & Mellichamp, 1975). As that paper was going through the press it was discovered that a distinctively different, and apparently undescribed, species was represented among a series of collections made in January, 1975 in the little-known part of the Sierra Madre Occidental that parallels the Río de Bolaños on the west, not far from the old mining settlement of Bolaños in northern Jalisco. This particular mountain-range was visited by Hartweg in the fall of 1837, and by J. N. Rose in the fall of 1897, but never before, as far as we are aware, by any botanist in the winter.

The mountains comprise a series of ridges trending generally north and south, and reaching an elevation of more than 2500 m in this area. There are no large streams. The hills support a dry pine-oak forest with some Rocky Mountain affinities (e.g. the pines are heavily parasitized by *Arceuthobium,* a genus otherwise little known in Jalisco). In Hartweg's time access to the Sierra was by what is now called the "Camino Viejo," a road built by the mining company in Bolaños to facilitate the transportation of timber to the mines from the high mountains. Traces of the old road, some paved with cut stone and wide enough for modern lumber-trucks, still persist on the rolling summits, but apparently have all been eroded away on the steep lower slopes.

The *Pedicularis* occurred in abundance in one seemingly restricted locality, in open sunny grassy spots under large pines, in loose gravelly soils. On January 21 at the height of the dry season not many other species were in full flower; some of those flowering, mostly Ericaceae and Compositae, were *Aster moranensis* H.B.K., *Baccharis squarrosa* H.B.K., *Brickellia jaliscensis* McVaugh, *Eupatorium longipes* A. Gray and *E. blepharilepis* Sch. Bip., *Gnaphalium salicifolium* (Bertol.) Sch. Bip., *Arbutus glandulosa* Mart. & Gal., *Arctostaphylos pungens* H.B.K., *Vaccinium stenophyllum* Steud., and *Lamourouxia longiflora* Benth. Of these *Eupatorium blepharilepis* and *Lamourouxia longiflora* apparently are near their southern limits here.

Pedicularis gordonii McVaugh & Koptur, sp. nov. Fig. 1.

Herba perennis 2–7 cm alta, glabra, caudice lignoso crasso 5–10 mm diametro, foliis rosulatis bipinnatis caulinibus, infimis squamiformibus scariosis, floribus e foliorum vix reductorum axillis ortis; folia subroseo-purpurea, ambitu lanceolata vel oblonga, (3–) 7–11 cm longa apice acuta, (0.5–) 1.5–2.5 cm lata basi truncata, pinnis 12–18 obovatis saepe dentatis, a laminae medio ad apicem decrescentes, dentibus (pinnulis) 0.3–2.5 mm longis, aliqui eborino-mucronatis; petioli (1–) 4–6 cm longi, marginati, ciliati; flores (5–) 12–16 in axillis superioribus, pedicellis 4–6 mm longis appressis; calyx zygomorphus, campanulatus, 7–9 mm longus, tubo 4–5 mm longo, lobis 5 acuminatis, abaxiali longiore 3–3.5 mm longo, lateralibus binis, sinu acuto separatis;

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FIG. 1. *Pedicularis gordonii,* drawn from the type by Karin Douthit. a, habit × 0.5; b, fruiting inflorescence × 0.5; c, seed × 7.5; d, capsule × 3.5; e, stamen × 5; f, g, flower, abaxial and lateral views × 2.5.

corolla 13–15 mm longa, alba, apicem versus rosea; galea 6–8 mm longa, compressa, oblonga, 2.8–3.5 mm lata; margo superior (adaxialis) convexus, apice abrupte rotundatus recurvatusque, exappendiculatus; corollae labium inferius leviter deflexum, quam galea multo brevior, 3-lobum, lobis intus ad basin tomentosis; stamina 4, 10–12 mm longa didynama, ad faucem infra bases corollae loborum 3.2–3.9 mm adnata; staminodium nullum; antherae 2–2.5 mm longae, in galeam inclusae, loculis basi acutis; stylus 7–10 mm longus, apice recurvatus exsertus; ovula 10–20; capsula glabra, asymmetrica, 6–7 mm longa, 3–4 mm lata, margine abaxiali recta, adaxiali convexa; semina 2 mm longa, 1 mm lata, laeviuscula oblonga.

Species in honorem diximus Gordon Duane McPherson (1947–), amici et species hujus repertoris, qui plantas mexicanas plurimas collectavit.

The plants as seen in the field appear to be acaulescent, but the leaves are in fact cauline, the lowermost consisting of imbricated light brown papery scales 5–10 mm long and 2–5 mm wide; the petioles are usually more than half as long as the blades; the acute sinuses between the

lateral calyx-lobes are about 3 mm deep, and the abaxial sinus a little deeper; the seeds (slightly immature) are essentially smooth, apparently with a narrow unilateral crest.

Known only from the type-collection, from the Sierra Madre ca 12–15 km (airline) SW of Bolaños, Jalisco, near the summits along the "Camino Viejo" to Berbería, elevation 2400–2550 m, 21 January 1975, *McVaugh 25882* (Holotype and Isotype, MICH).

Apparently no similar species is known from Mexico. In habit and in many superficial characters, *P. gordonii* resembles *P. centranthera* A. Gray and *P. semibarbata* A. Gray, both of which are species of the southwestern United States. The former, in which both flowers and fruit are considerably larger than those of *P. gordonii,* has the anthers 4 mm long including the long caudate tips. In *P. semibarbata,* which is primarily Californian, the flowers are scarcely larger than those of *P. gordonii,* and the anthers lack the long tails of *P. centranthera* but the corolla is externally short-pilose, and inflorescence as a whole tends to be pilose.

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A NEW SPECIES OF *ARBUTUS* (ERICACEAE) FROM WESTERN MEXICO

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The species-complex for which the oldest name is *Arbutus menziesii* Pursh varies to such an extent over a wide geographical range that there has been no general agreement upon the delimitation of taxa of specific or infraspecific rank within the complex. More or less distinguishable regional populations have been treated as species, e.g. *Arbutus menziesii* Pursh from California to British Columbia, *A. peninsularis* Rose & Goldman in Baja California, *A. arizonica* (A. Gray) Sarg. in southwestern United States and northern Mexico, *A. texana* Buckl. in Texas, New Mexico, and adjacent Mexico, and *A. xalapensis* H.B.K. throughout most of Mexico. Some of the same populations have been given varietal names under *A. menziesii* or *A. xalapensis.* Standley (Contr. U.S. Nat. Herb. 23: 1099. 1924) recognized 7 species in Mexico, saying at the same time, "It appears probable that ultimately all of them will have to be considered mere forms of *A. xalapensis.*" In the more than 50 years since Standley's opinion was published, there has been no significant increase in our knowledge of these trees that comprise an important element of the montane forests in most parts of Mexico. A revision of the entire complex is needed. It is therefore with some trepidation that we describe and name what seems to be a distinct taxon that has been passing as a part of the complex, and indeed has been confused with *A. xalapensis* (sensu lato) when any attempt has been made to determine specimens of it.

In passing it may be noted that at least two of the species included by Standley are apparently not conspecific with *A. xalapensis.*

Arbutus spinulosa Mart. & Gal. (Bull. Acad. Brux. 9, pt. 1: 532. 1842), of which the type (*Galeotti 1836*) came from an elevation between 7000 and 8000 feet on the north side of Cerro Tancítaro, was described as fruticose, with oblong-lanceolate leaves 5 inches long, 8–10 lines wide, spinulose-denticulate, ashy-pubescent beneath, the racemes congested, subpaniculate, pubescent-tomentose, with linear bracts longer than the pedicels. We suspected that this might be identical with our var. *villosa*, described below. Through the kindness of the authorities at Brussels (BR) we have been able to examine the type of *A. spinulosa,* which proves to represent not a species of *Arbutus,* but the narrow-leaved, non-glandular plant currently passing under the name of *Arctostaphylos rupestris* Rob. & Seat. (Proc. Amer. Acad. 28: 112. 1893). The name *Arbutus spinulosa* cannot be transferred to *Arctostaphylos* because of the existence of *Arctostaphylos spinulosa* Mart. & Gal. (Bull. Acad. Brux. 9, pt. 1: 537. 1842).

Arbutus glandulosa Mart. & Gal. (Bull. Acad. Brux. 9, pt. 1: 533. 1842), based on *Galeotti 1832,* from Ejutla, Oaxaca, was described as having the branches, petioles, and peduncles hirsute-tomentose with dark, glandular hairs, and the leaves spinulose-denticulate and cordate at base. We have not seen the type, but a tree answering this description is common in western Mexico, and seems strikingly different from everything in the complex of *A. xalapensis.* Most parts of the plant are copiously beset with gland-tipped setae (1–) 2–4 (–7) mm long, much longer than the delicate upright nonglandular hairs that are mingled with them. This glandular-hirsute plant often grows in association with the so-called *A. xalapensis,* and is usually readily distinguishable from that species by the glandular-setose herbage, by its flowering season, which seems to be consistently 3–4 weeks earlier than that of *A. xalapensis,* and by its rough, flaking, but persistent bark, which often contrasts markedly with the smooth lustrous bark of *A. xalapensis* that results from the loosening of the outer layers. The plant that we are calling *A. glandulosa* is often the most abundant *Arbutus* in mountain forests in western Mexico from Chihuahua southward.

Collectors in western Mexico have recently been noting the occurrence of an *Arbutus* which is always a small shrub, in contrast to *A. xalapensis* which is usually treelike and sometimes very large, with trunk occasionally up to 1 m in diameter, and a height of 15 m or more. Material of this shrubby plant seems to differ consistently in a number of ways from plants of the *A. xalapensis*-complex, and we propose to treat it as a distinct species, distinguished as follows:

1. **Habit.** We considered and rejected the possibility that the shrubby habit is not genetically fixed, i.e. that collectors had taken specimens that were in fact flowering shoots from stumps of larger trees that had been cut. In at least three widely separated areas collectors have commented on the habit in ways that seem to show conclusively that the plants are not treelike: In western Durango, "a prostrate, much branched shrub" (*Ownbey & Ownbey 1868*); "prostrate shrub less than 1 [foot] high, to 4 [feet] wide" (*Kimnach & Brandt 1204*); "shrub, 2 ft. forming colonies, decumbent" (*Lundell 13016*); "shrub 30 cm high in colonies" (*McVaugh 11531*). In Jalisco, "colonial shrub 30–50 cm high" (*McVaugh 23129*); "shrub forming low, wide-spreading, colonies 25 cm high . . . handsome groundcover" (*Boutin & Brandt 2537*). In Michoacán and México, "scraggly shrub 1 m high or sprawling on the rocks" (*Hinton 13500*); "total height of plant 50 cm; these branches grow from a large root 50 cm in diameter" (*Hinton 7458*).

2. **Foliage.** Leaves of the shrubby plant are in general smaller, narrower (both relatively and absolutely), more consistently toothed, and with shorter petioles, than those of *A. xalapensis,* sens. lat. Maximum leaf (blade)-length is about 7 cm, and most leaves on flowering shoots are 3–6 cm long (on *A. xalapensis,* as far as we have observed it, the maximum is about 15 cm, and the usual 7–10 cm) (Fig. 1, h). Maximum width of the leaf-blade is about 3 cm, and most leaves are 1–2 cm wide (8.5 cm, and 3–5 cm in *A. xalapensis*). Petioles average about 1 cm long (0.5–2.5), and on the average are about one-fifth as long as the blades; in *A. xalapensis* they average 2.5 cm long [1–4.2 cm], and are about one third as long as the blade. Pubescence, if present on the lower (abaxial) side of the leaf, tends to be generally distributed, whereas in *A. xalapensis* it is rather markedly concentrated toward the midvein. In the shrubby plant the leaves may be entire or toothed in the same colony, but most leaves are finely and uniformly serrulate, whereas in *A. xalapensis,* at least in western Mexico, the leaves are all entire in many specimens.

3. **Flowers.** Flowers are produced in the shrubby plant from January to March, and fruit may be found on the plants from June to November. The corollas are 4–5 mm long (average 4.66 mm), and are described as "faint pink," "bright pink," "red," "pale pink, darker distally and on lobes," or "creamy white with pink blush." In *A. xalapensis* as represented in western Mexico, the flowering season extends from early October to February, and fruit may be found from October through the following summer. The corollas are 5–6 mm long (average 5.86 mm), and are described as white or cream color, greenish yellow or green distally (Fig. 1, i, j).

4. **Floral bracts.** In the shrubby plant these are (4–) 4.7 (–7) mm long, about equalling or longer than the corolla; in *A. xalapensis* they are (3–) 3.4 (–4) mm long, shorter than the corolla (Fig. 1, i).

5. **Fruit.** The berries in the shrubby plant are 4.5–8 mm in diameter as far as known, and those in *A. xalapensis* 8–10 mm.

In summary, the shrubby plant differs from the complex of *A. xalapensis* not only in habit, but in leaf-shape and -margin, leaf-size, petiole-length and blade/petiole ratio, and distribution of pubescence on the leaves; in inflorescence characters there are differences in length of flowering season, in flower-size and -color, in fruit-size, and in the ratio between bract-size and flower-size. We believe this combination of features justifies the recognition of the shrubby plant as an independent species:

FIG. 1. *Arbutus occidentalis* and *A. xalapensis.* a–e, *A. occidentalis,* var. *occidentalis,* from the type. a, flowering twig × 0.5; b, flower and bract × 3.5; c, d, lateral and adaxial views of anther × 10; e, ovary and disk × 10. f, g, var. *occidentalis,* from *McVaugh 21697.* f, fruiting twig × 0.5; g, fruit and bracts × 3. h–j, *A. xalapensis,* from *McVaugh 14271,* Jalisco. h, leaf × 0.5; i, flower and bract × 3.5; j, anther × 10. Drawings by Karin Douthit.

Arbutus occidentalis McVaugh & Rosatti, sp. nov., frutex colonialis vix metralis, foliis ellipticis raro ovatis, plerumque serrulatis, 7 cm longis vel brevioribus, quam petiolis ca. 5-plo longioribus; laminae glabrae vel subtus omnino sublanosae, acuminatae vel acutae, basi plerumque obtusae; petioli (0.5–) 1 (–2.5) cm longi; inflorescentia terminalis racemosa 3–7 cm longa vel prope basin 1–3-ramosa; flores albi vel roseati, corollis 4–5 mm longis, bracteis (4–) 4.7 (–7) mm longis, quam corollis saepe longioribus; ovarium 5-loculare; loculis multiovulatis; ovula quoque loculo ca 10, biseriata axillaria; fructus diametro 4.5–8 mm rubri, ca 10-spermi, endocarpio coriaceo, seminibus 1.5–2 mm longis.

A shrub commonly 0.25–1 (sometimes to 1.4) m high, forming colonies up to 2 m wide or more; bark thin, red to red-brown, exfoliating; leaves mostly 3–6 cm long

and 1–2 cm wide, ca 2.5 times as long as wide; serrulations fine and sharp, seldom blunt, commonly extending nearly the whole length of the blade or the leaves sometimes even on the same plant partly or wholly entire; inflorescence often simple, the lateral branches, if any, often shorter, sub-basal; bracts ovate, more or less clasping, reddish or scarious, acute or obtuse, mostly 4–6 mm long, exceeding the pedicels in anthesis, but the pedicels in fruit and old flower becoming 5–8 (–15) mm long; anthers 1–1.5 mm long, bicornute; fruit tuberculate, fleshy, not juicy, described as "red," "bright red" or "scarlet," "acid," or "sweet to the taste"; seeds about 2 in each locule, soft, pale brown, ellipsoid-oblong to subglobose, somewhat angled by mutual pressure, finely lineate-reticulate.

Two varieties, morphologically and regionally separated, may be distinguished as follows:

1. Leaves quite glabrous or sparingly pilose beneath; petioles, if pubescent, usually more so adaxially; glandular hairs of the inflorescence inconspicuous or almost wanting; bracts mostly 4–5 mm long; Durango to Jalisco. var. *occidentalis.*
1. Leaves copiously wooly-villous beneath; petioles about equally pubescent on all sides; glandular hairs of the inflorescence numerous and conspicuous; bracts mostly 5–7 mm long; eastern Michoacán to Oaxaca. var. *villosa.*

Arbutus occidentalis McVaugh & Rosatti, var. **occidentalis**. *Arbutus occidentalis* McVaugh & Rosatti, quoad typum. Fig. 1, a–g.

Mountains in pine-, pine-oak, or pine-*Cupressus* forest, spreading on rocks and rocky summits, or steep slopes in open rocky soil, elevation 2100–2750 m.

JALISCO: Autlán, Sierra de Manantlán, along lumber-roads east of the summit between El Chante and Cuzalapa, lat. 19°35′ N., long. 104° 8′–15′ W, summits of cliffs in pine forest, elev. 2750 m, flowering 20–21 March 1965, *McVaugh 23129* (MICH, type).

Additional specimens examined: DURANGO: South and west of El Salto, *Ownbey & Ownbey 1868* (fr Sep), *Kimnach & Brandt 1204* (fr Nov), *McVaugh 11531* (imm fl Mar) (all MICH); north of Coyotes Station, *Maysilles 8397* (lvs Aug), *McVaugh 21697* (fr Sep), *Breedlove 18738* (fr Nov) (all MICH); northeast of Ataes, Distr. Santiago Papasquiaro, *Lundell 13016,* fl Apr (MICH). AUGASCALIENTES: 12 km southwest of La Congoja, Mpio. San José de Gracia, *Rzedowski & McVaugh 799*, lvs Oct (MICH). JALISCO: Near type-locality above abandoned site of El Guízar, "3100 m," *Boutin & Brandt 2537*, fr Nov (MICH).

Arbutus occidentalis McVaugh & Rosatti, var. **villosa** McVaugh & Rosatti, var. nov. a var. *occidentali* foliis subtus copiose villosis, petiolis omnino pubescentibus, bracteis longioribus, inflorescentiis pilis glandulosis conspicue capitatis differt.

Mountains, in pine forest as far as known, spreading on cliff-summits and steep rocky slopes, elevation ?2500–3350 m.

MEXICO: Between Cumbre and Cimientos, Temascaltepec, on cliff in pine forest, flowering 26 Jan 1936, *Hinton 8847* (MICH, type).

Additional specimens examined: MICHOACAN: Between Zitácuaro and Cacique, elev. 3350 m, *Hinton 13500,* fr & bud late Nov (MICH, US). MEXICO: Cajones, Distr. Temascaltepec, *Hinton 7458,* fl Mar (MICH); between Cumbre and Cimientos, *Hinton 8962,* fl Mar (MICH); Almoloya, Distr. Sultepec, *Hinton 15422,* fl Feb (US). OAXACA: Cerro de Humo in Sierra de Juárez, *Alexander 829,* fl Mar (MICH).

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THREE NEW SPECIES OF *TRIUMFETTA* FROM WESTERN MEXICO

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The American species of *Triumfetta* (Tiliaceae) were revised more than a quarter-century ago by Ko Ko Lay (Ann. Missouri Botanical Garden 37: 315–395. 1950). He recognized 43 American species, about half of which were known from the Pacific slope of Mexico from Guerrero westward and northwestward. The material available to him from that part of Mexico was rather scanty, but in the intervening years botanical exploration has been proceeding rapidly, and it is not surprising that we now have material representing three distinctive species that appear to be undescribed. Two of these species are from the mountains of Jalisco, from areas very little explored before 1950, and the third is from the coastal lowlands of southern Nayarit and adjacent Jalisco, areas inadequately explored even today. All three species have the arcuately recurved (uncinate) hyaline spinules of ovaries and fruits, that characterize the Series *Uncinatae* as understood by Ko Ko Lay. We do not feel that this one feature affords a valid taxonomic separation from the members of the genus in which the spinules are straight or only slightly deflexed. A number of species-pairs with different types of spinules appear to be related in other ways, and we suspect that over-emphasis upon the spinule character may obscure the true relationships in the genus. A complete analysis of this is outside the scope of this paper.

Two of the new species described below have flowers that are large for the genus (sepals mostly 3.5–4.5 cm long, combined with petals 7.5–8 mm long), and the third is unique in having the vegetative parts pilose with long simple hairs, and in the very long (5–6.5 mm) sterile tips of the sepals. The following key should serve to separate the new taxa from others already known from the same general area on the Pacific slope of Mexico:

1. Petals and sepals both more than 2.5 cm long; spines of the fruit commonly 200 or more, 5–10 mm long, plumose; petioles ca 1 cm long or less. *T. polyandra* DC.
1. Petals 2.5 cm long or less, the sepals sometimes longer; spines up to 100, seldom more, 5 mm long or less (usually much less), never long and plumose; petioles various.
   2. Sepals on open flowers 4–4.5 cm long; petals 7.5–8 mm long; fruit densely gray-pubescent, the spines ca 35–100, uncinate, 1–2 (–4) mm long, 0.5–1 mm thick at base; herbage minutely stellate, the leaves essentially glabrous except for long hairs in the vein axils.
      3. Inflorescence and mature buds nearly glabrous, with small sausage-shaped to cylindrical glandular trichomes; petioles glabrous; spines of the fruit ca 100. *T. gonophora*, sp. nov.
      3. Inflorescence evidently stellate-pubescent, the buds densely so, the glands visible among the hairs; petioles stellate-pubescent; spines of the fruit 35–50. *T. indurata*, sp. nov.
   2. Sepals 2.5 (–2.9) cm long or less, if more than 2 cm long the petals ca 1.5 cm long or more; fruit glabrous or glandular, seldom (?never) densely pubescent, the spines elongate, seldom (?never) much thickened at base; leaves various.
      4. Sterile tips ("appendages") of the sepals 5–6.5 mm long; calyx glabrous; herbage copiously pilose with simple hairs 2–5 mm long; spines of the fruit 100–130, 2–4.5 mm long, uncinate, stiffly retrorsely hispid. *T. medusae*, sp. nov.

4. Appendages 3 mm long or usually less; calyx mostly (?always) stellate-pubescent; herbage glabrous to coarsely stellate-pubescent; spines various.
   5. Petioles with 2–4 prominent spherical glands at the summit; sepals 2.2–2.9 cm long at anthesis; petals 2–2.3 cm long; fruit unknown; spinules of the ovary straight or deflexed, not uncinate; petioles 1.5 cm long; leaves elliptical, acute; stamens 20. *T. cucullata* Fern.
   5. Petioles without glands at the summit, the lower foliar teeth sometimes much thickened and enlarged; sepals shorter, if 2 cm long or more, then evidently longer than the petals; leaves and petiole-length various.
      6. Petals 1.2–1.8 cm long; sepals at anthesis 1.8–2.5 cm long; stamens 20 (–25 in one species).
         7. Leaves obtuse or short-pointed, as wide as long or up to 1.5 times longer than wide, pale and stellate-tomentose beneath, or the hairs merely intricately overlapping, with branches 1 mm long; spines uncinate. *T. discolor* Rose
         7. Leaves caudate-acuminate, at least those in the inflorescence about twice as long as wide, nearly glabrous to thinly stellate-pubescent beneath, the branches of the hairs mostly less than 1 mm long.
            8. Leaves below the inflorescence up to 6–12 cm wide, on petioles 5–11 cm long; axils of the basal and lateral veins on the lower leaf-surface conspicuously bearded, the surface itself minutely stellulate-puberulent on the veins, otherwise glabrous; fruits and bases of spines loosely short-pilose; spines with uncinate tips. *T. barbosa* Ko Ko Lay
            8. Leaves below the inflorescence 2–4 cm wide, on petioles 1–2.5 cm long; axils of the lateral veins not bearded, the basal somewhat so; fruits puberulent or pubescent to nearly glabrous.
               9. Spines of the fruit with straight or slightly deflexed hyaline tips; fruit 4-locular; leaves appearing subglabrous, thinly stellulate-puberulent and bearded in the basal axils beneath, commonly with few or no large stellate hairs, and few long simple hairs. *T. goldmanii* Rose
               9. Spines with uncinate hyaline tips; fruit 3-locular; lower leaf-surface commonly loosely and conspicuously, rather coarsely pilose with stellate and simple hairs intermingled. *T. columnaris* Hochr.
      6. Petals 1 cm long or less; sepals at anthesis 1.3 cm long or less (if 1.3–1.6 cm long, the longer petioles only 1–1.5 cm long); stamens 20–40. [Extralimital species].

Triumfetta gonophora W. W. Thomas & McVaugh, sp. nov. Fig. 1, h–n.

Arbor 4 m alta, 10 cm diametro, glabra; folia ovata, supra glabra, subtus venarum axillis basalium pilis caespitosis 1 mm longis instructa, basi rotundata, apice attenuata subcaudata, marginibus serratis; venatio palmata, venis majoribus 3–5; petioli tenues 2.5–5 cm longi; stipulae deciduae subulatae 4–5 mm longae; inflorescentia terminalis et axillaris, ramis 10–25-floris; pedicelli 8–10 mm longi, fructiferi 10–13 mm; gemma anthesis initio anguste ovoidea, 2.5–3.3 cm longa; sepala lanceolata attenuata 4.1–4.5 cm longa, 5–6 mm lata, appendicibus 1.5–2 mm longis; petala sublinearia 8 mm longa, 1 mm lata basi pilosa; gonophorum cylindricum, glandulis oblongis 1.3–1.5 mm longis basi acutis praeditum; urceolus subrigidus glaber, patens, lobulatus; stamina ca 20, glabra, 3–4 cm longa; antherae (1.5–) 1.9–2 mm longae; styli 3.5–4 cm longi; ovarium orbiculare, ad 2 mm diametro, uncinato-spinulosum; fructus (immaturus) orbicularis, 4-locularis, 6–8 mm diametro, spinis 100–120, spinulis inflexis, arcuatis.

Essentially glabrous, the stems and petioles reddish, the flowers bright yellow; leaves 7.5–11 cm long, 3–4.5 cm wide, ca 2.5 times as long as wide; marginal serrations shallow, 0.5–1.5 mm wide, the basal teeth bearing apical glands ca 0.5 mm in diameter, the surfaces with scattered red glands; flowers mostly in terminal 2–3-flowered cymules that are repeatedly surpassed by the axillary branches of the

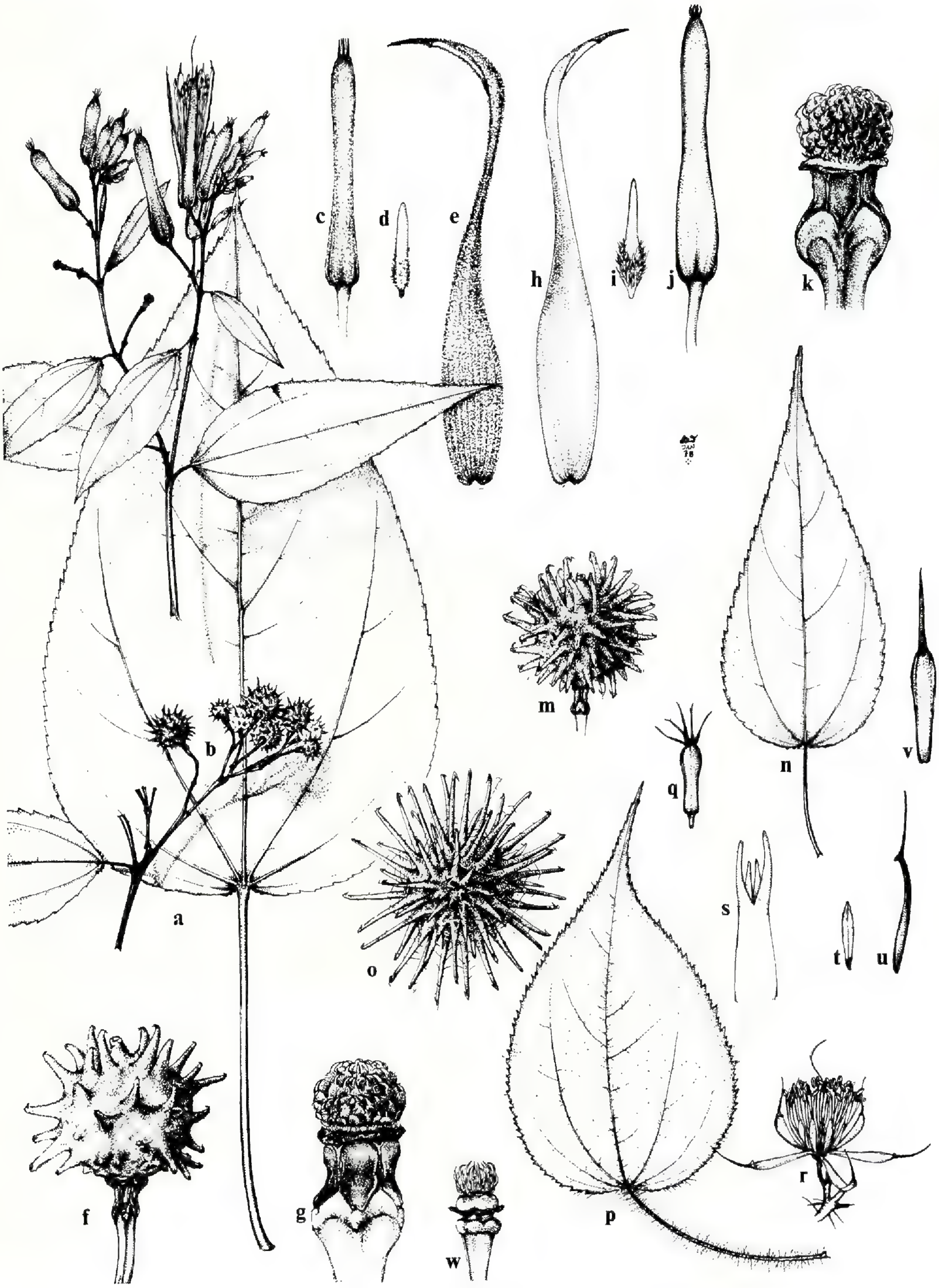

FIG. 1. *Triumfetta.* a–g, *T. indurata*; a, b, f, g, from the type, c–e from *McVaugh 21302.* a, leaf, and flowering twig × 0.5; b, fruiting twig × 0.5; c, bud × 1; d, petal × 1.5; e, sepal × 2; f, fruit × 2; g, ovary and gonophore × 5. h–n, *T. gonophora,* from the type. h, sepal × 2; i, petal × 2; j, bud × 1; k, ovary and gonophore × 5; m, fruit × 2; n, leaf × 0.5. o–w, *T. medusae*; o from *Anderson & Anderson 6024*, p–w from the type. o, fruit × 2; p, leaf × 0.5; q, bud × 1; r, flower × 1; s, style-tip × 25; t, petal × 1.5; u, v, lateral and adaxial views of sepal × 1.5; w, ovary and gonophore × 5. Drawings by Karin Douthit.

inflorescence; bracts leaflike, greatly reduced; sepals fused at base, somewhat stellate-pubescent especially near the margins on the inner surface; ovary and fruit, including spines, hispid with stellate hairs in part, these matted between the spines; spines rigid, subulate, conic at base, 1.5–2.5 mm long.

Known only from the barranca-forests on the seaward-facing slopes of the Sierra de Manantlán, Jalisco, 30–35 km SE of Autlán, between El Chante and Cuzalapa, where it is abundant at elevations of 1500–1900 m, with *Podocarpus, Quercus, Ostrya, Matudaea,* and other deciduous trees, collected in flower 22–23 March, 1965 (*McVaugh 23229,* MICH, holotype).

This new species somewhat suggests in appearance other large-flowered species of western Mexico, e.g. *T. barbosa* and *T. columnaris.* From both it differs in having flowers almost twice as large, and sepals longer in proportion to the petals, as well as in having shorter and stouter spines. In *T. columnaris* the herbage is more or less scurfy-stellate, and in *T. barbosa* the urceolus is strongly ciliate.

Triumfetta indurata W. W. Thomas & McVaugh, sp. nov. Fig. 1, a–g.

Arbor 3–10 m alta, minute stellato-pubescens; folia ovata, supra subglabra, subtus sparce pubescens et venarum axillis basalium pilis simplicibus 1 mm longis instructa, basi rotundata vel subtruncata, apice acuminata, marginibus serratis, dentibus basalibus in glandulas cupuliformes sensim transeuntibus; venatio palmata, venis majoribus 3–5; petioli (3–) 5–10 cm longi densiuscule pubescentes; stipulae mox deciduae, subulatae, pubescentes, 4–8 mm longae; inflorescentia terminalis et axillaris, ramis 20–50-floris; pedicelli 6–7 mm longi; gemma anthesis initio 2.7–2.9 cm longa, anguste oblonga, dense pubescens vel etiam pilosa; sepala lanceolata attenuata 4–4.3 cm longa, 4 mm lata, appendicibus 3–4 mm longis; petala sublinearia 7.5–8 mm longa, 1 mm lata, basi pilosa; gonophorum cylindricum, glandulis oblongis 1.5–1.8 mm longis basi acutis praeditum; urceolus subrigidus glaber (vel sparce ciliatus), patens, lobulatus; stamina (20–) 30, ca 3 cm longa, glabra; antherae 1.3–1.8 mm longae (–2.1 mm longae humefactae); styli ad 4 cm longi; ovarium oblatum, ad 1.6 mm latum, uncinato-spinulosum; fructus lignosus, orbicularis vel oblatus, 4–5 (–6?)-locularis, corpore 8–10 mm diametro, spinis 35–50, spinulis inflexis, arcuatis.

Herbage and inflorescence at least when young rather densely pubescent with minute stellate trichomes and beset with numerous minute elongate red glandular trichomes; stems and petioles often reddish, the flowers bright or light yellow; leaves mostly 10–20 cm long below the inflorescence, 5–10 cm wide, 1.8–2.5 times as long as wide; marginal teeth irregular, 0.5–1 mm wide; cupuliform glands 1–3 pairs, crowded at the base of the blade, sessile or slightly stalked; flowers tending to be clustered in small cymules near the tips of the panicle-branches; bracts leaflike, greatly reduced; sepals connate at base and subpersistent, densely stellate-pubescent without or with additional few or many long hairs up to 0.7 mm long; ovary and fruit, including spines, densely short stellate-pubescent, appearing gray or canescent; spines rigid, subulate, 1.5–3 (–4) mm long including the conic base.

Seaward-facing slopes and ravines, in barranca-forest with *Magnolia, Fraxinus, Prunus, Cornus,* and *Garrya,* or in drier and more disturbed situations with *Prunus, Fraxinus, Trema, Inga, Dendropanax, Ficus,* where it is locally abundant in several places, 1200–1500 m, flowering October to March.

JALISCO: Below the pass to Talpa de Allende, 10–12 km above La Cuesta, tropical subdeciduous forest in ravines, elev. 1400 m, fruiting and almost past flower 30 March 1965, *McVaugh 23363* (Holotype, MICH).

Additional specimens examined: JALISCO: Near the type-locality, probably not the same individual plants collected, in young flower 16 October 1960, *McVaugh 20312* (MICH); in flower and immature fruit 22 November 1960, *McVaugh 21302* (MICH); San Sebastián, trail to El Ranchito, *Mexia 1444* (MICH); 15–30 km N of Mascota, road to San Sebastián, *Anderson & Anderson 5980* (MICH).

The two collections from the Mascota-San Sebastián area differ from the others in having the leaves somewhat more broadly ovate, and in the calyx, which is densely long-pilose in Mrs. Mexia's collection and somewhat less densely so in Anderson's collection. The material from Talpa is essentially without long hairs on the calyx. In Ko Ko Lay's revision, *Mexia 1444* was referred to *Triumfetta speciosa* Seem., a similarly large-flowered but otherwise quite different species that ranges from Veracruz and Chiapas to Panama.

We suppose that *T. indurata* is rather closely related to the newly described *T. gonophora,* and that any seemingly close relationship with *T. speciosa* is a specious one because of the considerable difference between the fruits of the two species.

Triumfetta medusae W. W. Thomas & McVaugh, sp. nov. Fig. 1, o–w.

Frutex gracilis, arcuatus, 0.7–1 m altus, conspicue hirsutus pilis simplicibus 2–5 mm longis; folia ovata vel interdum trilobata, supra pilis longissimis exceptis glabra, subtus venis majoribus pilis obsita, superficie stellato-pubescentia, stellis 2–7-radiatis usque ad 1 mm diametro; laminae basi rotundatae vel cordatae, apice longe acuminatae vel subcaudatae, marginibus ciliatis argute serratis; venatio palmata, venis majoribus plerumque 5; petioli hirsuti 2–5 cm longi, superiores breviores; stipulae subpersistentes lanceolatae vel basi inaequaliter obliquae, ciliatae, 7–10 mm longae; inflorescentiae ramos terminantes, 5–20-florae, cymis pro maxima parte brevipeduculatis lateralibus ad modum racemi dispositis; pedicelli 1–2 mm longi; gemma anthesis initio anguste obovoidea vel pyriformis, 7–9 mm longa; sepala oblongo-linearia, cucullata, 1–1.2 cm longa, 1.6–1.9 mm lata, appendicibus subapicalibus 5–6.5 mm longis filiformibus; petala sublinearia 6–6.5 mm longa, 1 mm lata, basi pubescentia, ciliata; gonophorum perbreve, vix 0.3 mm longum, 1–1.5 mm latum, glandulis subquadratis; urceolus conspicuus, vix lobatus, ciliatus; stamina 17–22, glabra, conspicua, filamentis 7.5–8 mm longis, applanatis 0.5 mm latis; antherae 1.3–1.7 mm longae; styli 1.5 cm longi; ovarium orbiculare 1 mm diametro, uncinato-spinulosum; fructus orbicularis, 5-locularis, corpore 6–7 mm diametro sparce stellato, spinis 100–130 subulatis 3–4.5 mm longis, retrorse hispidis, spinulis inflexis, arcuatis.

Branches up to 1 cm in diameter or more, arising from a heavy rootstock; filaments conspicuous, yellow, the small yellow petals and the herbaceous or reddish-green calyx not showy; stems sometimes reddish; leaves 5–10 cm long, 3–7 cm wide, 1.3–2 times as long as wide; marginal teeth 0.7–2 mm wide, often large and small alternating, the basal ones neither much enlarged nor conspicuously glandular; lateral branches of the raceme-like axes mostly less than 1 cm long, the flowers subsessile in clusters of about 5 or fewer; bracts leaflike, mostly lanceolate, 1–5 cm long; sepals at anthesis soon separating to the base, spreading or reflexed.

Known only from the Pacific lowlands, on rocky slopes near the ocean or in hillside oak-savannah associations, from sea-level to an elevation of 200 m, collected in flower 28–29 October, and in old fruit 7 March.

NAYARIT: precipitous hills in oak-savannah zone 11 km by road E of Las Varas toward Compostela, 28–29 October 1971, *Dieterle 3969* (Holotype, MICH).

Additional specimen examined: JALISCO: On Bahía de Banderas 9–12 km [S] by road from Puerto Vallarta, 7 March 1970, *Anderson & Anderson 6024* (MICH).

This species is so different from any other Mexican representative of the genus that its relationships are completely in doubt. It is immediately recognizable by the presence of long straight simple hairs in abundance on most parts of the plant, and by the unusually long sepal-appendages. Similarly long appendages are known in two other species, *T. purpusii* Standl. and *T. falcifera* Rose, neither of which resembles *T. medusae* in other ways. The epithet *medusae* is in reference to the cluster of appendages, variously curved, contorted and intertangled, that crowns each flower-bud.

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